THURSDAY, JUNE 7, 1888.

TECHNICAL EDUCATION.

WE are glad to see that the Government Bill for the Promotion of Technical Instruction (which we print elsewhere) is down for second reading as first order of the day on June 14. The objects effected by this Bill are substantially the same as those of the Government Bill of last year, and of that already introduced by Sir Henry Roscoe and other friends of education, this year, on behalf of the National Association for the Promotion of Technical Education. That is to say, it is an enabling Bill, giving powers to localities, if they think fit, to apply local rates to the purpose of promoting technical instruction.

In Clause 6, "technical instruction" is defined to mean "instruction in the principles of science and art applicable to industries, and in the application of special branches of science and art to specific industries or employments." It does not include teaching the practice of any trade, or industry, or employment; but, subject to this reservation, it includes "instruction in the branches of science and art with respect to which grants are for the time being made by the Department of Science and Art, and any other form of instruction which may for the time being be sanctioned by that Department by a minute laid before Parliament, and made on the representation of a School Board or local authority that such a form of instruction is required by the circumstances of its district." This definition appears good, so far as it goes, but in our opinion it does not go far enough, for it does not specifically include, as Sir Henry Roscoe's Bill does, the commercial subjects and modern languages. This, however, may easily be amended by a slight alteration of the wording of Clause 6, which should read: "Technical instruction means instruction in subjects applicable to industry and commerce, and in the application of special branches of science and art to specific industries and employment." It is, however, to be noticed that Clause 5 suggests the possibility of Imperial grants in aid of instruction in technical subjects in the words, "Every minute of the Department of Science and Art with respect to the condition on which grants may be made for technical instruction shall be laid on the table of both Houses of Parliament." What the precise nature and amount of such grants may be is not stated, and we shall await with interest the explanation of the Government on this essential point.

In any case, however, it will be necessary that such grants should be accompanied by inspection under Imperial authority, but this does not necessarily form part of the Bill, which, after all, is one simply for giving rating power, and only contains one compulsory clause, viz. that in which School Boards availing themselves of the provisions are required to grant similar powers to voluntary schools in their districts claiming such powers, up, be it always understood, to the limit of one penny in the pound.

There are many points of difference between this Government Bill and that of last year. In the first place, the clause giving powers, granted by the last Bill, to fifty ratepayers to demand a poll is very wisely omitted from this Bill. In the second place, under the Bill of last year the powers of promoting technical instruction could only be exercised by School Boards or by Town Councils where School Boards do not exist. No provision was made for districts in which neither exist. Under the present Bill, where a School Board does not exist, the powers may be exercised by any local authority which can carry out the Public Libraries Acts, and this gives, of course, a much wider sphere of action than the former Bill. But, more than this, the present Bill gives power to Town Councils and other local authorities to grant aid from the rates (even where a School Board exists) to supply higher technical instruction, whereas under the former Bill technical instruction both of an elementary and of a higher character was in the hands of one authority, viz. that of the School Board. Another new point is that the annual rate in aid for technical instruction is limited to one penny in the pound in the case of that levied by the School Board, and at twopence in the pound where the powers given under the Public Libraries Acts are exercised concurrently. In the Bill introduced on behalf of the National Association no such limit is named. Possibly, in view of Parliamentary objections, some limitation is advisable, although very serious objections may be raised to this proposal. Admission to technical schools and classes, may, under Sir Henry Roscoe's Bill, be granted to all comers who pay the required fees; powers being, however, given to Boards and local authorities to institute an entrance examination in reading, writing, and arithmetic, should they think fit. The Government adhere to their former proposal to restrict all attendance in these schools and classes (with the exception of those in which manual instruction alone is given) to such pupils as shall have passed an examination equivalent to that of the Sixth Standard. The exception made this year in favour of manual instruction is a step in the right direction. We should have preferred perfect freedom of admission in the Technical, as is now the case in the Science and Art Classes of the Department, or at least to leave it to the locality to determine whether any such entrance examination is advisable or not.

No powers are granted in the Government Bill respecting payment of fees to deserving students or for the establishment of scholarships, as in Sir H. Roscoe's Bill. These seem to be minor defects, which can be easily remedied. A more important point, and one concerning which not only much discussion in the House of Commons may be expected, but upon which the success or failure of the Bill will probably depend, is the much-vexed question of whether, and, if so, under what conditions, any aid from local rates can be given for the special purposes of technical instruction to public elementary schools not under control of a School Board, *i.e.* to voluntary or denominational schools. Here the difference of opinion between the two great political parties is very marked. One party will not on any consideration sanction payment from the rates

unless the spending of this is placed under the definite control of the ratepayers; the other will not permit the Board schools to reap a distinct advantage which is withheld from those carried on by voluntary enterprise. The Bill of the Association summarily cuts the Gordian knot by specifically excluding voluntary schools from participation in income derived from the rates; naturally, therefore, denying to any higher institution of a distinctly denominational type similar assistance. Sir Hart Dyke's Bill, on the other hand, having in its first clause declared that "Any School Board in England may from time to time supply or aid the supply of such manual or technical instruction, or both, as may be required for supplementing the instruction given in any public elementary school in its district, whether under its own management or not," goes still further in its second clause, and makes distinct provision as to the equality of treatment between Board schools and voluntary schools such that, if the Board aids its own schools, "it shall, on the request of the managers of any other public elementary school in its district fulfilling like conditions as to the supply of manual or technical instruction in that school, aid the supply of such instruction in that school in like manner as it aids such supply in the school or schools under its own management, subject to such terms as may be agreed on or determined in pursuance of this Act." Moreover, if the managers object to these terms, the Department of Science and Art shall act as umpire. The support or opposition to this Bill by those who object to payment from the rates without representation, and therefore the probable success or defeat of the measure, will, we venture to think, much depend upon the exact meaning which the Government attaches to these "terms of agreement." If the expression may be taken to mean that the School Board shall have some direct representation by its members on the governing body of the voluntary schools to whom that Board makes grants, *quâ* the technical instruction given in such schools, some of the opposition may possibly be removed. But this should be distinctly expressed; indeed, it would be better to make such an arrangement imperative. If this meaning is not to be attached to these words, we fear that the Bill will lose the support of very many ardent educationalists in the House.

Another provision which we do not find in the Government measure is the one contained in the third clause of the Association Bill, and also in the fourth clause of the Government Bill of last year, in which School Boards may join together to contribute towards the promotion of technical instruction, power being already possessed for this purpose by local authorities under the Public Libraries Acts. This power, in the case of small or sparsely-populated districts, is especially important, with a view to the foundation of higher elementary technical schools, which from their nature do not need to be very numerous, and which the School Boards of many of the single areas of the kind included in the Bill would be quite unable to create or maintain.

The above by no means exhausts the points which may be brought up for discussion on this Bill. It will, however, serve to show the general scope of the Bill, which, unless greatly modified, cannot, we fear, be considered a satisfactory one.

OLD BABYLONIAN AND CHINESE CHARACTERS.

The Old Babylonian Characters and their Chinese Derivates. By Terrien de Lacouperie. (London: Nutt, and Trübner and Co., 1888.)

PROF. TERRIEN DE LACOUPERIE has long been known as the advocate of a theory which would bring the ancestors of the Chinese from Western Asia, and see in the characters they employed derivatives from the cuneiform symbols once in use in Babylonia. The proofs of his theory have been gradually placed before the learned world. In two articles published in the Journal of the Royal Asiatic Society he has endeavoured to trace the history of the Yh-King, the oldest and most mysterious of Chinese books, and to show that its earliest portions contain lists of characters and their meanings, ancient poems and similar fragments of antiquity, misunderstood and misinterpreted by successive generations of commentators. Elsewhere he has given us for the first time a rational account of the vicissitudes undergone by the Chinese system of writing, based upon the statements of the Chinese writers themselves. Lately he has communicated to the Philological Society an interesting and exhaustive description of the languages spoken in China before the arrival of the "Bak" tribes or Chinese proper, as well as of the modern dialects which are descended from them. Now we have the last instalment of his proofs in the shape of a comparison between the primitive forms of the Chinese characters and the pictorial forms out of which the cuneiform script subsequently developed. Prof. de Lacouperie claims to have proved in a typical number of instances that the correspondence is exact, or fairly so, as regards form, signification, and phonetic value; and that consequently an early connection between Chinese and Babylonian must be assumed. Since the Babylonian forms can be shown to presuppose those of China, we must bring the Chinese from the West, and not conversely the Babylonians from the East.

I am not a Sinologist, and therefore can pronounce no opinion on the Sinological side of the argument. Chinese scholars must determine how far Prof. de Lacouperie's restoration of the primitive forms and values of the Chinese signs is correct. Assuming it to be so, the resemblance between many of them and the corresponding characters of Accadian Chaldæa is certainly surprising.

On the Babylonian side, Prof. de Lacouperie has been at great pains to secure accuracy, and has left but little to criticize. *Zik*, however, it may be observed, is not a value of the Babylonian ideograph of "ship," but goes back to an erroneous conjecture of Dr. Hincks; and the original meaning of the character which has the value of *pa* was "the leaf" or "leafy branch" of a tree.

The Babylonians seem never to have forgotten that the cuneiform characters they used had originated in pictures. Indeed, their scribes long claimed the privilege of adding to them, the result being that hieroglyphic forms took their place in the texts by the side of forms that had long degenerated into a cuneatic shape. The original hieroglyphics had been the invention of the so-called Accadians, the early population of Chaldæa, who spoke agglutinative dialects, and were eventually superseded by the Semites.

The Semites received the hieroglyphics from their inventors after they had already assumed a cuneatic form, and added still further to the heritage. When the Semitic king Sargon I. was reigning in Babylonia in B.C. 3800, the scribes at his court were still occupied in devising new forms of characters, and in increasing the number of phonetic values the student was required to learn. This is the cause of the fact pointed out by Prof. de Lacouperie, that, whereas most of the cuneiform characters have to be turned on their sides in order to be restored to their primitive position (Chaldæan writing having once been traced in vertical columns), there are other characters which have never been thus displaced. As time went on, the forms of the characters became more and more distorted; the number of persons in Babylonia who could read and write was very large, and while the general form of script varied from age to age, the individual in each age was distinguished by a peculiar form of handwriting as much as is the individual of to-day. An official script never prevailed in Babylonia as it did in Assyria, where education was practically confined to the class of scribes; and while, therefore, the Assyrian student has little need of learning more than one form of writing as long as he confines himself to the monuments of Assyria, he is bewildered by the number of cursive hands which the documents of Babylonia oblige him to decipher.

The oldest Babylonian monuments yet known are those discovered by the French Consul M. de Sarzec at Telloh in Southern Babylonia. They are earlier than the epoch of Sargon I., and belong to the pre-Semitic era. The inscriptions engraved upon them still preserve in some measure the old vertical arrangement of the characters, and in some few cases the characters themselves have a pictorial form. But more generally they have already become cuneatic, and not unfrequently have departed so widely from their primitive appearance as to make it impossible even to guess what they were primarily intended to represent. If this were the case in the fourth millennium before our era, we may have some idea of the vast antiquity to which the beginnings of Babylonian writing must reach back.

In other instances, though the transformation of the character is not so complete, it is difficult to determine with certainty the object originally portrayed. Some of Prof. de Lacouperie's examples are in this plight, and as regards at least two of them—those pronounced *da* and *du* or *tur*—I prefer the explanations suggested by Mr. Pinches and Mr. Bertin to those suggested by himself. In fact, in the first case he has misinterpreted, like the earlier Assyriologists, the Assyrian explanation of the ideograph *nasu sa nisi*; which signifies, not "the summit of man," but "the lifting up of a man." It is consequently natural to regard it as representing the uplifted arm.

Prof. de Lacouperie rejects the theory which saw in the mountains of Elam the birth-place of Babylonian writing. Whatever, however, may be the value of the arguments urged by the advocates of this theory, the arguments brought against it by Prof. de Lacouperie do not appear to me to be cogent. Certainly it is not my experience that the coast of a flat country like Chaldæa "always looks mountainous" to the seafarer; while the Accadian word *a* (misprinted *ai*) signifies "father," not because of the ideographic meaning of the character which represented it, but because the Accadian *ada*, "father," became in pronunciation, through phonetic decay, first *ad*, and then *a*. The symbol of "country" attached to the ideographs of "man" or "servant," "handmaid" and "wild ox," need not have been introduced before the Accadians had long been settled in the Babylonian plain, and it is not quite correct to say that "while [Babylonian writing] possesses primitive symbols for 'boat' and for 'wind,' represented by an inflated sail, there are none for 'river.'" Both "ship" and "river" are alike denoted by a double ideograph.

The question, however, whether the cuneiform system of writing originated in "the mountains of the East," as the Babylonians called them, or in the islands of the Persian Gulf, does not affect Prof. de Lacouperie's main contention. If this can be established, a new and important chapter will be opened in the history of the ancient East, and the mystery which has so long enveloped the origin of the Celestial Empire will be cleared away. I must leave it to the Sinologists to determine whether, on the Chinese side, Prof. de Lacouperie's conclusions are sustainable; on the Babylonian side, he has nothing to fear from Assyrian scholars.

A. H. SAYCE.

DR. EIMER ON THE ORIGIN OF SPECIES.

Die Entstehung der Arten auf Grund von Vererben erworbener Eigenschaften nach den Gesetzen organischen Wachsens. Von Dr. G. H. Theodor Eimer, Professor der Zoologie und vergleichenden Anatomie zu Tübingen. (Jena: Gustaf Fischer, 1888.)

IT is a little curious that, although Darwin was so much more an experimenter than an anatomist, the immediate stimulus of his work was to anatomy, and not to experiment. There is, however, ample evidence that morphology is beginning to advance on the lines prophesied for it at the end of the "Origin of Species," and that morphologists are to enter the "almost untrodden field of inquiry on the causes and laws of variation, on correlation, on the effects of use and disuse, on the direct action of external conditions."

Dr. Eimer's book is written from the stand-point of one who believes that there is more to be made out of the study of the influence of the environment on a single set of organisms than of the anatomy and microscopy of many organisms. It is an abundant storehouse of facts, old and new, about the influence of the physical environment. Many curious problems are dealt with, and the infinite fertility of the field of investigation is shown. But the book claims to be far more than this: it claims to supply a new theory of the organic world—a theory in which natural selection plays only a casual and incidental part.

Dr. Eimer starts from the premiss that natural selection is insufficient to account for the evolution of the organic world because it is essentially the rule of chance. One had thought that this misconception had, even in the controversy of the ignorant, long ago died of inanition. Not only is the whole tenour of Darwin's book opposed to such a conception, but Darwin has specifically guarded against it. For him and for his theory "chance" is but a convenient way of denominating processes of whose

details, from their complexity or from their intricacy, we are ignorant.

From his study of the life-conditions of some lizards, Dr. Eimer has reached the conclusion that at any given time variations occur only in a few definite directions. These directions depend on inner constitutional causes. The variations are produced by the direct action of the environment, are always transmitted, and when accumulated, become the inner constitutional cause determining the direction in which the organism will respond to new stimuli. In old males which have been subjected for a longer time than other forms to the environment there is a tendency to the appearance of new characters. These show the direction in which species-variation is going to take place. Not only does the ontogeny repeat the phylogeny in a condensed form, but the later stages of the ontogeny are prophetic of the new phylogeny. Variation, so directed and limited, assimilation causing growth, and reproduction or discontinuous growth, are the chief laws of organic growth.

Suppose a primitive undifferentiated plasma capable of responding to stimuli of heat, light, moisture, &c. In response to the action of the environment ever slightly varied in such details, various conditions would "crystallize out" of the plasma, just as from a homogeneous inorganic mass crystals form in varied groups. As the organic world continued to grow, this original differentiation would increase. With increase of complexity due to the storage in each generation of the complete effect of the environment on each stage of the phylogeny, the different directions in which forms were developing would become more different. Each new character appearing would through correlation influence the whole organism. Allow a little to natural selection and a little to the results of sexual mingling, and the varied species, orders, and classes into which the organic world can now be divided appear as the inevitable result of its mode of growth. There is no need to search for intermediate forms: they may never have existed. As the branching of a tree is the natural consequence of its mode of growth, so is separation and isolation inevitable in the whole organic world.

The two crucial points in Dr. Eimer's theory are his view of the action of the environment and his extreme Lamarckian acceptance of the transmission of acquired characters. Probably he is correct in his supposition that the extent of the direct action of the environment has as yet been unappreciated. Many characters hitherto unexplained may come to be referred to direct action, and experiment only can determine its scope. But it is no explanation of the presence of chlorophyll to refer it with the author to the continued action of sunlight upon protoplasm. And still less is it an explanation of the difference between queen and worker bee to refer it to the difference in their food. But indeed in this latter case the refutation of the author is easy. The neuter is not a different kind of bee produced by a different kind of food. It is merely an arrested queen—a queen that has not become something else on account of a different diet, but a queen that is not quite a queen because it has not had enough to eat. That this is the true state of the case is apparent from the less specialized colonies of wasps. There the queen in spring lays female eggs, and has herself to forage for the whole brood. As a result the young do not get enough to eat, and the development of their sexual organs is arrested. They in turn help to feed the next brood, the individuals of which reach a further state of development. As the summer wears on, the ever-increasing band of workers bring in an increasing supply of food, till finally a condition is reached when there is enough food to make perfect females of a whole brood. Clearly the bee colony, with its sharper distinction between neuter and queen, is merely a specialization of this condition. It is but a verbal explanation of the difference between queen and neuter to refer it to the direct action of food upon the organism. Moreover, to explain the condition of things even in the wasp colony, natural selection is necessary. Obviously, insufficient food would arrest general development as well as sexual development, and natural selection acting on variations naturally arising had to select those whose genitalia suffered most with least detriment to general powers. From the many interesting cases adduced by the author, this one has been selected because it is fairly typical of the slight grounds on which he refers important characters to the direct action of the physical environment.

As for the inheritance of acquired characters, it may be said at once that Dr. Eimer has added nothing of importance to the controversy. He certainly has adduced a few isolated cases that seem to be explained best on this theory; and were the inheritance of acquired characters merely of incidental value to his argument, his easy acceptance of the traditional view might avoid criticism. But when it is said that the direct action of the environment, together with inner constitutional causes, produces varieties and species, and that these inner constitutional causes that determine the direction of variation are merely a summation of direct action, a summation effected by inheritance, we perceive at once that a new and all-important *rôle* is assigned to heredity. There is no attempt to meet the serious theoretical difficulties involved in every conception of the mechanism of the inheritance of acquired characters: there is no adequate attempt to establish the fact. Were it possible and were it true, undoubtedly it would be, as Dr. Eimer in elaborate and learned detail has shown, of immense importance. But to prove its possibility or truth Dr. Eimer has done little or nothing.

Dr. Eimer appears to have mistaken a generalized expression of the process of evolution for an explanation of it. Natural selection acts at a time only on the one or two characters which the environment temporarily elevates into criteria of existence. But, as these change, there are changed with them a vast multitude of minor characters—in a word, there results what the author happily calls "kaleidoscopic variation." These changes can be referred only indirectly to selection, though they may play no inconsiderable part in determining the appearance of the organism. With all these variations are correlated variations in the results produced by the direct physical action of the environment.

Dr. Eimer has concentrated his attention on these secondary and certainly neglected changes, and his theory is a statement of their course. But he has brought forward no motive power to take the place of natural selection in determining the ruling changes; and there-

fore his generalized statement, even when raised into a law and dignified with a name, is not an explanation of the phenomena. Darwin has convinced men of evolution where Lamarck failed and where certainly Dr. Eimer would fail, not because he discovered any law, but because he discovered an intelligible mechanism, an obvious sequence of cause and effect, which could, and probably did, act. P. C. M.

OUR BOOK SHELF.

The Birds of Dorsetshire: A Contribution to the Natural History of the County. By J. C. Mansel-Pleydell, B.A., F.L.S., &c. 8vo. pp. i-xvi., 1-179. (London and Dorchester: R. H. Porter, 1888.)

Notes on the Birds of Herefordshire, contributed by Members of the Woolhope Club. Collected and Arranged by the late Henry Graves Bull, M.D., &c. pp. i-xxxii., 1-274. (London and Hereford: Jakeman and Carver, 1888.)

COUNTY lists of birds are still the order of the day. First we have Mr. Mansel-Pleydell's book on the Ornithology of Dorsetshire, a very neat little volume, compiled evidently with the greatest care. The author's long acquaintance with the country and his well-known love of natural history have rendered him the most competent authority on the subject, and he has been aided by many well-known naturalists in supplying him with instances of the capture of rare birds, so that the list is a very complete one. The inevitable Great Black Woodpecker (*Picus martius*) of course appears, on Pulteney's authority, but no recent specimen is extant, nor is likely to be. The Pied-billed Grebe (*Podilymbus podiceps*), which was first recorded by ourselves as a British bird, is placed between brackets, and considered to be "extremely doubtful" by the author. All we can say is that we should not have been godfather to the specimen, to add one more doubtful species to the already overburdened British list, unless we had felt tolerably certain of its authenticity, while the fact of the specimen being immature renders its occurrence as a chance wanderer much *more* probable than if it had been an adult bird in breeding-plumage. The bird has ten times more claim to a place amongst our stragglers than such species as *Picus medius*, *Pycnonotus barbatus*, and dozens of others. A most interesting history is given of the celebrated swannery at Abbotsbury, with a photographic plate, in which the birds are well depicted, but the keeper's face lacks expression! Some pretty woodcuts by Mr. Lodge are interspersed in the text. The author informs us that *Puffinus obscurus* (p. 113) should be *P. griseus*.

Dr. Bull's "Birds of Herefordshire" is one of the most useful of the county lists; for it contains a complete list of British birds, with special notes on the Herefordshire species. A great deal of care has evidently been taken over this book, which is rendered more interesting by the poetical researches of the author. Mr. Phil. Robinson, when he issues a new edition of his "Poets' Birds" will certainly have to consult this work of Dr. Bull, which contains many quotations we have not seen elsewhere.

R. BOWDLER SHARPE.

Geology for All. By J. Logan Lobley, F.G.S., &c. (London: Roper and Drowley, 1888).

THE object of this little book is to give an account of the important facts and deductions in geology, without "unnecessary scientific terminology." That there is room for such a work will not be questioned, and doubtless many who have paid no heed to the subject would begin to study it if only their lessons were made easy and attractive. This was accomplished in old times by Hugh Miller, and more recently by Canon Kingsley in his charming "Town Geology"; and Mr. Lobley, in his enthusiastic preface, raises the hope that he will follow a similar course, and provide "all intelligent readers" with a simple record of the earth's history. In this respect, however, we are disappointed. The work is a condensed account of the leading geological facts and deductions, arranged much after the fashion of an ordinary text-book. Of its general accuracy and clearness we can speak with confidence; and indeed, through his long connection with the Geologists' Association, the author has had ample opportunities of qualifying himself for his task. The work, however, is more adapted for the young student who wishes to pursue the subject, than for the general reader. We fear the patience of the latter will be tried when he reads the explanations—and not always happy explanations—of outcrops, anticlinals, unconformities, and outliers, for there are no diagrams to give pictorial aid. Nor is the chapter on the composition of rocks likely to prove more readable; for surely the accounts of the physical characters of minerals, and the chemical formulæ, introduce "unnecessary scientific terminology." Again, when we read of the acidic and basic rocks, of the seismic focus and the meizoseismic curve, of the "homocircle (*sic*) or equal-lobed tailed fishes," and of those that present a "heterocircle-tailed character," we feel that the author has not sufficiently carried out his good intentions. In the chapter on metamorphic rocks a popular account might have been given of recent researches in the Highlands, and then perhaps the author would not have remarked that "rarely a reversed-fault is seen." H. B. W.

Sound, Light, and Heat. By Thomas Dunman.
Electricity and Magnetism. By the same Author.
(London: Ward, Lock, and Co., 1888.)

THESE two books are revised reprints of the articles on the subjects which have already appeared in Messrs. Ward, Lock, and Co.'s well known "Universal Instructor." They have been published in their present form for the convenience of students. The work of revision and expansion has been undertaken by Mr. Chapman Jones, the death of the original author having rendered it necessary for other hands to perform this part of the work.

As might be expected, the books are of a popular character, but their value to students of elementary physics does not in the least suffer on this account. The almost entire absence of mathematical statements makes them suitable for the most elementary students.

The method of treatment is that of the orthodox text-book, and there is very little that calls for special remark. They differ mainly from other elementary text-books inasmuch as they are brought quite up to date, especially in electrical matters. The 300 diagrams which are distributed throughout the text, though not of a high order of excellence, will do much towards enlightening the minds of those who read the books.

Though not designed to suit the syllabus of any examining body, they are well adapted for students preparing for the Science and Art Department examinations.

Sea-side and Way-side. By Julia McNair Wright.
(Boston: D. C. Heath and Co., 1888.)

THIS little volume is the first of a series of "Nature Readers," intended for the use of beginners in reading. As a rule, the authors of reading-books take little trouble to excite the interest of children. Their object is to bring together a number of simple sentences, and they seem to be indifferent whether the sentences express sense or nonsense. In the present series an attempt will be made to

convey, through reading-lessons, some of the more attractive elementary facts of science; and, if we may judge from the degree of success attained in "Sea-side and Way-side," the volumes are likely to be cordially welcomed in many primary schools in England as well as in the United States. The author has taken, as the subjects of her lessons, crabs, wasps, bees, spiders, and shell-fish; and she has contrived to put into the simplest and most direct language a great deal of really useful and entertaining information. Almost all children find something to interest them in what they are told about the habits of animals, and it is not improbable that these bright and pleasant lessons will implant in a good many young minds the seeds of an enduring love of natural history.

Reminiscences of Foreign Travel. By Robert Crawford. (London: Longmans, Green, and Co., 1888).

MR. CRAWFORD is already favourably known as the author of "Across the Pampas and the Andes." The present volume will maintain his reputation as a traveller who knows how to observe what is most significant in the countries he visits, and who possesses the faculty of reproducing his impressions in a lively and attractive narrative. His reminiscences relate to Canada, Austria, Germany, Sardinia, Egypt, Algeria, and various other lands; and in every chapter he records something that most readers will find fresh and interesting. The most instructive sections of the book are, upon the whole, those relating to Canada and Algeria.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Dr. Giglioli and Lepidosiren.

DR. GIGLIOLI asserts, in his interesting letter published in the last issue of NATURE (p. 102), that the Lepidosiren whose capture he records is "the fifth specimen known." Reference to his earlier remarks (NATURE, vol. xxxv. p. 343), concerning that which he regards as "the fourth known" specimen, shows that while he has acknowledged the examples of Natterer and Castlenau, he has apparently overlooked that of Bibron and H. Milne-Edwards, recorded in 1840. Readers of NATURE interested in this wonderful creature, now apparently verging on extinction, will find a *résumé* of all that is topographically important concerning the last-named and the three previously recorded specimens in the *Zoolog. Jahrb.* for 1887 (pp. 575 to 583). For this welcome communication, to which a full bibliography is appended, we are indebted to Dr. G. Baur, of Yale College Museum, U.S.A. It forms one of the series of historical miscellanea with which he has enriched our recent literature; and, if the conclusions at which he (in common with Brühl) arrives are sound, Dr. Giglioli's "fifth" specimen will be in reality a sixth.

Zoologists in general will unite in congratulating Drs. Rodriguez and Giglioli upon their recent acquisition; and while hoping for a repetition of the same, they will eagerly await the results of the promised "future study." G. B. HOWES.

South Kensington, June 2.

"A Text-book of Biology."

WILL you allow me to point out that the reviewer, in your issue of May 17 (p. 52), apparently misunderstands the object of my "Text-book of Biology"? The work is not meant to supplant lectures, but to aid them, by reducing for the student the wearisome labour of note-taking, and by enabling the teacher to enlarge where necessary, and to treat the subject from other points of view, running meanwhile less risk of addressing an audience of mere scribbling-machines.

The review also implies that a previously published work covers the same ground as the present book. This, however, is not the case, as my book deals with the *Botany* as well as with the Zoology of the course.

I cannot but think that the reviewer is led by his enthusiasm into the common mistake of demanding that the ordinary "pass" man shall follow the same course as the specialist. I suppose that the University of London prescribes at the Intermediate Pass stage a portion, not too small, of Biology, which shall form part of a general course of science adapted to the average student, and to *the time at his disposal;* perhaps your reviewer will kindly explain, less vaguely, what other system he would propose to substitute? J. R. AINSWORTH DAVIS.

Aberystwyth, May 24.

Resistance of Square Bars to Torsion.

THE attention of writers on Applied Mechanics should be called to the error continuously repeated in about thirty editions of the late Prof. Rankine's different works which have appeared during the last thirty years. The error is still reproduced in quite recent works of other writers: Prof. Ewing's article, "Steam-Engine," in the Encyclopædia Britannica; Prof. Unwin's "Elements of Machine Design"; Prof. Alexander's "Elementary Applied Mechanics"; &c.

It is stated that the moment of resistance of a square bar to torsion appears from Saint-Venant's investigations to be—

$$0{\cdot}281\, fh^3,$$

where f = maximum intensity of stress, and h = side of the square. This formula is also quoted at discussions of Institutions of Engineers and accepted without dissent. It is easily seen to be wrong, because the moment of torsion of a round bar of equal area is only

$$0{\cdot}282\, fh^3.$$

The error is reproduced in the text of Prof. Cotterill's "Applied Mechanics," but is corrected in an appendix, where the author says Rankine gives the formula without further explanation. The explanation is that on the old theory the torsional moment of inertia was—

$$I = \frac{h^4}{6},$$

which had to be multiplied by the maximum intensity of stress and divided by the corresponding radial distance—namely, from the centre to the middle of the side, giving the moment of resistance

$$= \frac{fh^3}{3}$$

on the old theory. (Rankine was aware that the maximum stress does not occur at the angles, as in Coulomb's method.)

Now, in Saint-Venant's "Mémoire," the *torsional rigidity* of a square bar is proved to be the fraction

$$0{\cdot}843$$

of the fallacious result of the old theory. Rankine accordingly wrote

$$0{\cdot}843 \times \frac{fh^3}{3} = 0{\cdot}281 fh^3$$

as the true moment of torsion.

But the *torsional rigidity* determines the *amount of twist*, and not the *maximum stress*. A few pages farther on, Saint-Venant gives the correct formula, equivalent to

$$\mathbf{0{\cdot}208}\, fh^3.$$

It seems strange that the talented author of the expressive distinctions *strain* and *stress* should himself have taken the formula for the strain instead of that for the stress. The reason is, that up to that date (Todhunter's "History of Elasticity") the strain and stress were supposed to be proportional to each other.

Abstracts of Saint-Venant's researches are given in Sir William Thomson's article "Elasticity," in the Encyclopædia Britannica, Thomson and Tait's "Natural Philosophy," and Minchin's "Statics." Strange that in all of these the method is given which determines the *strain* to be 0·843 of the old fallacy, while nothing is said about what is of more importance in Applied Mechanics, the maximum *stress*, nor the *moment of resistance to torsion*, as given above.

Perhaps this hint may be attended to in future editions.

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THE GEOLOGICAL STRUCTURE OF SCANDINAVIA AND THE SCOTTISH HIGHLANDS.

THE obvious connection and analogy between the geological structure of the crystalline rocks of the Highlands of Scotland and those of Scandinavia have long engaged the attention of geologists. Among the northern observers to whose labours we are largely indebted for our knowledge of the Scandinavian regions, Dr. A. E. Törnebohm has proved himself a keen and indefatigable explorer of the Swedish uplands. Many years ago he showed that above clay-slates and limestones, with recognizable Silurian fossils, there lies a great thickness of quartzites, gneisses, and schists, called by him the Seve group. In more recently studying the relations of these rock-masses, he encountered some great difficulties, of which he sent me at the time an account. I could not pretend to solve them, but suggested, as at least a working hypothesis, that the Scandinavian structure might be fundamentally similar to that now recognized as characteristic of the North-West Highlands, where the apparent conformable superposition of a series of schists upon fossiliferous Lower Silurian strata has been produced by great terrestrial displacements, whereby the overlying rocks have been crushed and deformed, until they have assumed a new crystalline structure along the planes of movement, these stupendous changes having occurred at some time subsequent to the Lower Silurian period. I have recently received from Dr. Törnebohm the following letter, which he gives me leave to publish, and which will no doubt be read with interest by those who are aware of the recent progress of research in this subject:—"It will perhaps interest you to learn that your suggestion four years ago regarding the construction of our Scandinavian *fjelds* has turned out to be correct, at least in my opinion. My late researches have little by little driven me to the conclusion that the crystalline schists belonging to what I have called the 'Seve group' have been placed over Silurian strata by an enormous eastward thrust. I admit that I have most reluctantly come to this conclusion, knowing that it implied a horizontal thrust of enormous masses of rock for more than 100 kilometres. Such a stupendous movement of entire mountain-regions is hard to realize; but facts are stubborn things."

It will be observed that Dr. Törnebohm speaks of the movement having been towards the east, whereas in the north-west of Scotland it has been in the opposite direction. In a more recent letter, in reply to one in which I had called his attention to this difference, he says:—"Though in Scotland the great thrusts are westward, in Scandinavia it is quite the reverse. Here the chief movement has been to the east or south-east. In the region of Trondhjem, indeed, there have been lesser movements towards the north-west, but these may have taken place somewhat later. At least I rather suspect this, but am not prepared positively to affirm it." I may remark that in Scotland also there are districts where the thrusts have not come from the normal direction but from the westward. In the Island of Islay, for example, I recently found the limestones and quartzites piled up by sharply-cut thrust-planes which had a general westward inclination at lower angles than the displaced strata. One of the great problems in working out the complicated geology of the Highlands is the determination of the positions and extent of such thrust-planes, and the direction in which the displaced rock-masses have been moved. There can be little doubt that much mutual help in this research will be gained by a co-operation between the field geologists who are engaged in the study of these problems in Scotland and in Scandinavia.

ARCH. GEIKIE.

TIMBER, AND SOME OF ITS DISEASES.[1]

VIII.

THERE is a large and important class of diseases of standing timber which start from the cortex and cambium so obviously that foresters and horticulturists, struck with the external symptoms, almost invariably term them "diseases of the bark"; and since most of them lead to the production of malformations and excrescences, often with outflowing of resinous and other fluids, a sort of rough superficial analogy to certain animal diseases has been supposed, and such terms as "canker," "cancer," and so forth, have been applied to them.

Confining our attention to the most common and typical cases, the following general statements may be made about these diseases. They usually result from imperfect healing of small wounds, the exposed cortex and cambium being attacked by some parasitic or semi-parasitic fungus, as it tries to heal over the wound. The local disturbances in growth kept up by the mycelium

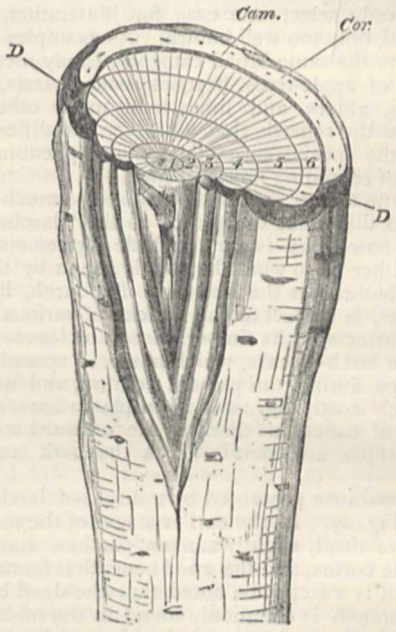


FIG. 28.—Piece of tree stem affected with "canker." The injury commenced after the two inner zones of wood (1 and 2) had been developed: it extended further in successive periods of growth, as shown by the receding zones 3, 4, 5, and 6, until all the cambium and cortex was destroyed except the pieces *D* to *D*. *Cam*, cambium; *Cor*, living cortex; *D D*, dead tissues. At each period of growth the attempt has been made to heal over the wound, as shown by the successively receding lips.

feeding on the contents of the cells of these tissues lead to the irregular growths and hypertrophies referred to; the wounds are kept open and "sore," or even extended, and there is hardly any limit to the possibilities of damage to the timber thus exposed to a multitude of dangers.

In Fig. 28 is represented a portion of a tree stem affected with "canker": the transverse section shows the periods of growth numbered 1 to 6 from within outwards. When the stem was younger, and the cambium had already developed the zones marked 1 and 2, the cortex suffered some injury near the base of the dead twig, below the figure 1. This injury was aggravated by the ravages of fungus-mycelium, which penetrated to the cambium and destroyed it over a small area: in consequence of this, the next periodic zone of wood (marked 3) is of course incomplete over the damaged area, and the cortex and cambium strive to heal over the wound by lip-like callus at the margins. The healing is prevented,

[1] Continued from p. 111.

however, by the mycelium, which is continually extending the area of injury: consequently the next zone of wood (4 in the figure) extends even a shorter distance round the stem, and so on with 5 and 6, the cambium being now restricted to less than half round the stem—*i.e.* from *D* to *D*, and the same with the living cortex. Of course the injured area extends upwards and downwards also, as shown by the lips of the healing tissue. As soon as the injury extends all round, the stem dies—it is, in fact, ringed. It is also interesting to note that the zones 4 and 5 (and the same would be true of 6 when completed) are thicker than they would have been normally: this is partly due to release from pressure, and partly to a concentrated supply of nutritive materials.

Much confusion still exists between the various cases: some of them undoubtedly are due to frost or to the intense heat of direct insolation; these are, as a rule, capable of treatment more or less simple, and can be healed up. Others, again, can only be freed from the irritating agents (which, by the bye, may be insects as well as fungi) by costly and troublesome methods.

I shall only select one case for illustration, as it is typical, and only too well known. As examples of others belonging to the same broad category, I may mention the "canker" of apple-trees, beeches, oaks, hazels, maples, hornbeams, alders, and limes, and many others; and simply pass the remark that whatever the differences in detail in the special cases, the general phenomena and processes of reasoning are the same.

Perhaps no timber disease has caused so much consternation and difference of opinion as the "larch-disease," and even now there is far too little agreement among foresters either as to what they really mean by this term, or as to what causes the malady. The larch, like other timber-trees, is subject to the attacks of various kinds of fungi and insects, in its timber, roots, and leaves; but the well-known larch-disease, which has been spreading itself over Europe during the present century, and which has caused such costly devastation in plantations, is one of the group of cancerous diseases the outward and visible signs of which are manifested in the bark and young wood.

The appearance presented by a diseased larch-stem is shown in Fig. 29. In the earlier stages of the malady the stem shows dead, slightly sunken patches, *a*, of various sizes on the cortex, and the wood beneath is found to cease growing: it is a fact to be noted that the dead base of a dried-up branch is commonly found in the middle of the patch. The diseased cortex is found to stick to the wood below, instead of peeling off easily with a knife. At the margins of the flattened patch, just where the dead cortex joins the normal living parts, there may frequently be seen a number of small cup-like fungus fructifications (Fig. 29, *b*), each of which is white or gray on the outside, and lined with orange-yellow. These are the fruit-bodies of a discomycetous fungus called *Peziza Willkommii* (Htg.), and which has at various times, and by various observers, received at least four other names, which we may neglect.

In the spring or early summer, the leaves of the tree are found to turn yellow and wither on several of the twigs or branches, and a flow of resin is seen at the dead patch of cortex. If the case is a bad one, the whole branch or young tree above the diseased place may die and dry up. At the margins of the patch, the edges of the sounder cortex appear to be raised.

As the disease progresses in succeeding years, the merely flattened dead patch becomes a sunken blistered hole from which resin flows: this sinking in of the destroyed tissues is due to the up-growth of the margins of the patch, and it is noticed that the up-growing margin recedes further and further from the centre of the patch. If this goes on, the patch at length extends all round the stem or branch, and the death of all that lies above is then soon brought about, for, since the young wood and cambium beneath the dead cortex are also destroyed, the general effect is to "ring" the tree.

To understand these symptoms better, it is necessary to examine the diseased patch more closely in its various stages. The microscope shows that the dead and dying cortex, cambium, and young wood in a small patch, contain the mycelium of the fungus which gives rise to the cup-like fructifications—*Peziza Willkommii*—above referred to (Fig. 30); and Hartig has proved that, if the spores of this *Peziza* are introduced into the cortex of a healthy living larch, the mycelium to which they give rise kills the cells of the cortex and cambium, penetrates into the young wood, and causes the development of a patch which everyone would recognize as that of the larch-disease. It is thus shown that the fungus is the immediate cause of the patch in which it is found.

The next fact which has been established is that the fungus can only infect the cortex through some wound or injury—such as a crack or puncture—and cannot penetrate the sound bark, &c. Once inside, however, the mycelium extends upwards, downwards, sideways, and inwards, killing and destroying all the tissues, and so inducing the outflow of resin which is so characteristic of the disease. The much-branched, septate, colourless

FIG. 29.—Portion of stem of a young larch affected with the larch-disease, as indicated by the dead "cancerous" patch of cracked cortex, *a*: at and near the margins of the patch are the small cup-like fructifications of *Peziza Willkommii* (Htg.), which spring from mycelium in the dead and dying cortex and cambium beneath. (After Hess.)

hyphæ can penetrate even as far as the pith, and the destroyed tissues turn brown and dry up.

After destroying a piece of the tissues in the spring, the growth of the mycelium stops in the summer, the dead cortex dries up and sticks to the wood, and the living cortex at the margins of the patch commence to form a thick layer of cork between its living cells and the diseased area.

It is this cork-formation which gives the appearance of a raised rim around the dead patch. It has long been known that the patches dry up and cease to spread in the dry season. It should be pointed out that it is one of the most general properties of living parenchymatous tissue to form cork-cells at the boundaries of an injury: if a slice is removed from a potato, for instance, the cut surface will be found in a few days with several layers of cork-cells beneath it, and the same occurs at the cut surface of a slip, or a pruned branch,—the "callus" of tissue formed is covered with a layer of cork.

If it is remembered that the cambium and young wood are destroyed beneath the patch, it will be at once clear that in succeeding periods of growth the annual rings of wood will be deficient beneath the patch.

Next year, the cambium in the healthy parts of the stem begins to form another ring; but the fungus

mycelium awakens to renewed activity at the same time, and spreads a little further upwards, downwards, and sideways, its hyphæ avoiding the cork-layer and traversing the young wood and cambium below. During this second spring, therefore, a still larger patch of dead tissue—cortex, cambium, and young wood—is formed, and the usual cork-layer describes a larger boundary. Moreover, since the cambium around the, as yet, undiseased parts has added a further annual ring—which of course stops at the boundaries of the diseased patch—the centre of the patch is yet more depressed (cf. Fig. 28).

And so matters go on, year after year, the local injury to the timber increasing, and ultimately seriously affecting, or even bringing to an end, the life of the tree.

At the margins of the diseased patches, as said, the fungus at length sends out its fructifications. These appear at first as very minute cushions of mycelium, from which the cup-like bodies with an orange-coloured lining

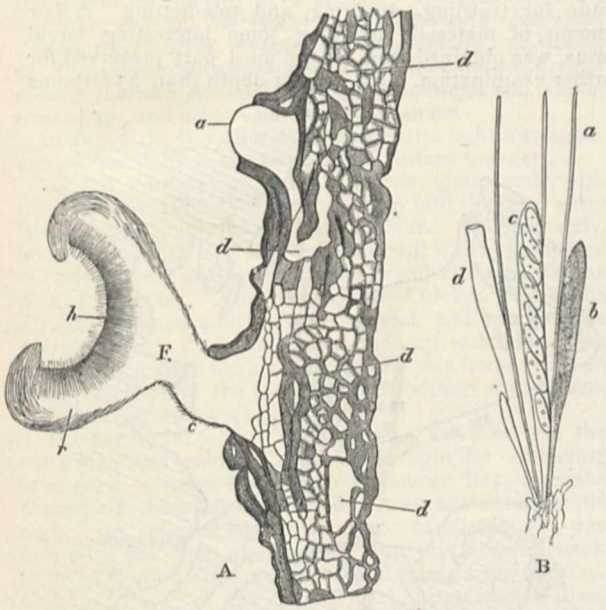


FIG. 30.—A, vertical section (magnified) through the dead cortex of a larch, infected with the mycelium (*d*) of *Peziza Willkommii* (Htg.), which is developing its fructifications (*a* and *E*). The mycelium fills up the gaps in the cortex, *d*, with a white felt-work. *a* is a boss-like cushion of this felt-work bursting forth to become a cup-like fructification; *F*, the mature *Peziza* fructification (in section); *c*, its stalk; *r*, the margins of the cup; *h*, the layer of spore-sacs (*asci*). B, four of the asci from *h*, very highly magnified. *a*, hair-like barren filaments between the asci; *c*, a fully-developed ascus, containing the eight spores; *d*, an ascus emptied of spores (they have escaped through the hole at the apex); *b*, a young ascus in which the spores are not yet formed: to the left below is a small one still younger. (After Hartig and Willkomm.)

arise: the structure of this fructification is best seen from the illustration (Fig. 30, A). The orange-red lining (*h*) is really composed of innumerable minute tubular sacs, each of which is termed an *ascus*, and contains eight small spores: as seen in the figure (Fig. 30, B), these asci stand upright like the pile of velvet lining the cup. They are formed in enormous numbers, and go on ripening and scattering the spores day after day. There are many interesting details connected with the development and structure of these fructifications and spores; but we may pass over these particulars here, the chief point for the moment being that very large numbers of the minute spores are formed, and scattered by the wind, rain, animals, &c. Moreover, as already stated, it has been shown by experiments that the spores will infect the stem of the larch if they are introduced into a wound; but it is important to notice that the fungus cannot penetrate the sound cortex.

It now remains for us to see if, in the natural course of events, infection of the larch can take place to any great extent; for, unless this is the case, we cannot reconcile the above peculiarities of the fungus with the prevalence of the disease.

It must be borne in mind that the larch is an Alpine tree, growing naturally at an elevation of from about 3000 to 6000 feet above sea-level, and even more. In its native heights, both the larch-disease and *Peziza Willkommii* occur associated as we have described them, but the malady does not become epidemic, as it has done in the valleys and plains of Europe.

Several insect-enemies of the larch are known, some of which feed on the buds, and others on the leaves, &c.: it is not impossible that insect-wounds may serve occasionally as points of entry for the fungus.

But attention should be directed to the remark made when describing the symptoms of the disease—namely, that a dead branch often springs from near the centre of the patch. Now it is a well-known fact in the hill-forests of Switzerland, Germany, Austria, &c., that heavy falls of snow often load the branches until they bend down to the ground, and the bark in the upper angle where the branch joins the stem is ruptured; similar cracks are also caused by the bending down of the branches under the weight of water condensed from mists, &c. If a spore alighted near such a place, the rain would wash it into the crevice, and it would germinate in the moisture always apt to accumulate there. This certainly accounts very completely for the situation of the dead branch, which of course would at once suffer from the mycelium. Another way in which such wounds as would give access to the parasite might arise, is from the blows of hailstones on the still young and tender cortex.

But probably the most common source of the crevices or wounds by which the fungus gains an entry is frost; and to understand this we must say a few words as to what is known of the larch at home in its native Alps.

It is well known, since Hartig drew attention to the fact, that in the high regions of the Alps the trees begin to put forth their shoots very late: the larch in the lowlands of Germany and the British Isles often begins to shoot at the end of March or beginning of April, whereas in the mountains it may be devoid of leaves in May. This is because the transition from winter to spring is very sudden on high slopes, whereas in the lowlands and valleys it may be very gradual. The consequence is that in the Alps, when the buds once begin to open they do this rapidly and vigorously, and the tender leaves and shoots are quickly formed and beyond the reach of those late spring frosts which do so much damage in our country: in the lowlands, on the contrary, the leaves slowly develop at a time when late frosts are very apt to recur at night, and they are for several weeks exposed to this danger; and if a sharp frost does come, the chances are that not only will the first output of tender leaves be killed off, but the whole shoot suffers, and frost-wounds are formed in the young cortex.

Another point comes into consideration also. In warm damp valleys the whole tree is apt to be more watery, and it is well known that the soft tissues, like the cortex, suffer more from frost when filled with watery sap, than do harder, drier, more matured ones. It has been shown, according to Sorauer, that dead patches, exactly like those which characterize the larch-disease in its early stages, can be artificially produced by exposing the stem to temperatures below zero, so as to freeze the water in the cells.

Given the above conditions for producing frost-wounds, then, and the presence of spores of *Peziza Willkommii*, there is no difficulty in explaining the well-known phenomena of the larch-disease.

But Hartig has brought to light some other facts of great importance in considering this admittedly complex question. We have already stated that the *Peziza*

does occur at the margins of the wounds in the Alps where the larch is native. In these higher regions, however, the air is usually dry during periods of active growth and the young fructifications of the fungus are particularly sensitive to drought; consequently, even when many scattered trees are infected, the cups developed at the edges of the wounds are apt either to dry up altogether, or to produce relatively few spores, and these spores have fewer chances of germinating. In fact, the fungus enjoys at best a sporadic existence, chiefly at the bases of trees where the herbage affords a certain degree of dampness.

When the larch was brought down to the plains and valleys, however, and planted in all directions over large areas, the *Peziza* was also brought with it; but it will be clear from the foregoing discussion that the climatic conditions were now proportionally raised in favour of the fungus, and lowered to the disadvantage of the larch. Plantations in damp valleys, or in the neighbourhood of the sea, or of large lakes, were especially calculated to suffer from frost, and the damp air favoured the propagation of the fungus, and the disease tended to become epidemic. The enormous traffic in larch plants also shows how man too did his share in spreading the epidemic; and in fact the whole story of the larch-disease is of peculiar interest biologically, as illustrating the risks we run every day in trusting to the chapter of accidents to see us safely through any planting undertaking, no matter how great the stake at issue, or how ruthless the interference with those complex biological and physical conditions which always play such an important part in keeping the balance in the struggle for existence between all organisms living together.

Let us now very shortly see what are the chief lessons taught us by the bitter and costly experience which the larch-disease brought to foresters. It is evident that the larch should not be planted at all in low-lying situations exposed to late frosts; and even in more favoured valleys experience points to the advantage of mixing it with other trees: large areas of pure larch are planted at enormous risk in the lowlands.

As to the treatment of trees already diseased, it is possible (when it is worth while) to remove diseased branches from trees of which the trunk and crown are healthy, but it hardly needs mention that such diseased branches must be burnt at once. As regards trees with the stems diseased—in those cases where the patches are large, and much resin is flowing from the wounds, experience points to the advisability of cutting them down. In those cases where the tree is already very large, and the diseased wound but small, it may be expedient to let them alone: theoretically they ought to go, or at any rate the diseased tissues be excised and burnt; but it seems to be proved that such a tree may go on forming timber for many years before the wound will spread far enough to reduce the annual increment below the limits of profit, and we all know the view a practical forester will take of such a case. At the same time, it is the duty of the man of science to point out that even such a tree is a possible source of danger to its neighbours.

H. MARSHALL WARD.

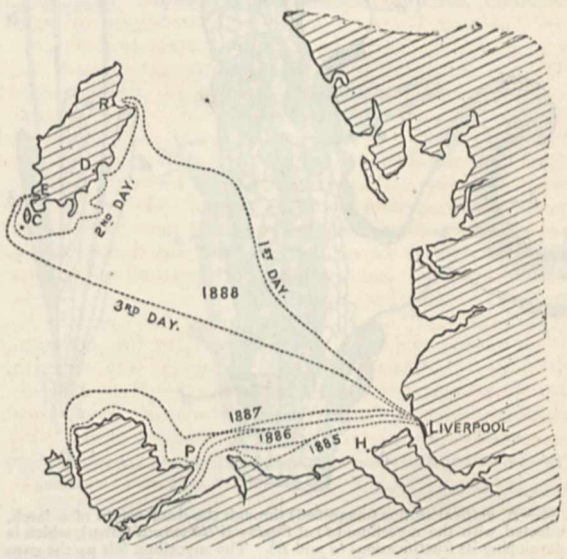
(*To be continued.*)

MARINE BIOLOGY AND THE ELECTRIC LIGHT.

THE Liverpool Salvage Association, with their usual liberality, placed their famous old steamer the *Hyæna* once more at the service of the Liverpool Marine Biology Committee this Whitsuntide, for a three days' dredging expedition. During the three former biological cruises of the *Hyæna* in 1885, 1886, and 1887, the region explored has been the southern part of the L.M.B.C. district, around the coasts of North Wales and Anglesey (see Fig.).

On the present occasion the Committee decided to run a couple of lines of soundings and dredgings between the Mersey and the Isle of Man, and to spend some time dredging round the southern end of that island; the general objects being (1) to get some knowledge of the depths, bottom, and animals, across the eastern half of the Irish Sea, and (2) to investigate the rich fauna living around the "Calf" and south end of the Isle of Man.

About 7 a.m. on Saturday morning, May 19, the *Hyæna* left the Liverpool landing-stage, with a party of nearly twenty biologists on board, and provided with dredges, trawls, tow-nets, sounding-line, deep-sea reversing thermometer, microscopes, and the other necessary instruments, dishes, bottles, and reagents. After the well-known sand-banks round the mouth of the Mersey had been passed, soundings and bottom temperatures were taken occasionally, and several times during the day a stop was made for trawling, dredging, and tow-netting. A fair amount of material, including some interesting larval forms, was obtained, and for the most part preserved for further examination. No greater depth than 23 fathoms



Map of the L.M.B.C. District, showing the course of the *Hyæna* in 1885, 1886, 1887, and 1888. H, Hilbre Island; P, Puffin Island; R, Ramsey; D, Douglas; E, Port Erin; C, the Calf.

was, however, met with; and there was nothing specially noteworthy amongst the animals dredged, so far as could be seen at the time.

It had been intended to anchor for the night in Douglas Bay, but during the dredging and trawling the vessel had drifted so far out of her course that when evening came it was found advisable to run for Ramsey. Here half the party went on shore for the night, the rest staying on board for the electric light experiments which will be described further on.

On the following morning an early start for the south was made, and the rest of the party was picked up at Douglas, and then the work of the day commenced. The *Hyæna* steamed slowly round the east and south coasts of the island to Port Erin, dredging and tow-netting at intervals, with very good results. When a stop was made for collecting, the fullest advantage was taken of it. The sounding-line and deep-sea thermometer were over amidships, and two dredges, a large bottom tow-net and one or more surface tow-nets, were put out astern. The deep tow-net, devised and worked by Mr. W. S. McMillan, was so weighted and buoyed as to work steadily at a

distance of a foot or so above the sea-bottom, and it yielded a large amount of material, which was in some cases conspicuously different from the contents of the surface nets, worked by Mr. I. C. Thompson during the same time.

A large area of the sea-bottom between Port Soderic and Port St. Mary is apparently covered by masses of *Melobesia calcarea* and the dead valves of *Pectunculus glycimeris*, and incrusting Polyzoa are especially abundant upon both the Nullipore and the shells. Mr. J. Lomas, who has charge of the Polyzoa, informs me that amongst a number of other rare forms he has identified *Stomatopora johnstoni* and *S. incrassata*, *Tubulipora lobulata*, *Lichenopora hispida*, *Cellepora dichotoma*, *Membranipora aurita*, and a peculiar variety of *Cellaria fistulosa*.

Towards evening three very successful hauls of the dredge were made, which covered practically all the ground in a line from the southern end of the "Calf" to the northern side of Port Erin Bay, just under Bradda Head. Amongst the material obtained in these hauls the following species were noticed: *Asterias glacialis*, *Solaster endeca*, *Stichaster roseus*, *Porania pulvillus*, *Luidia fragilissima*, *Antedon rosaceus*, *Ebalia* sp., *Xantho* sp., *Pleurobranchus membranaceus*, *Ascidia venosa*, *Ascidia plebeia*, *Corella parallelogramma*, *Polycarpa* sp., *Leptoclinum* sp., and other Compound Ascidians.

In Port Erin Bay after dark the electric light was again used successfully in the bottom and surface tow-nets.

On the third day an early start was again made, with the object of leaving time to run down into the deep water lying to the south of the Isle of Man. Unfortunately, however, a thick fog was encountered, which hampered our movements during the morning and changed all the plans for the day. After passing the "Chicken" Rock, the *Hyæna* steamed slowly for Liverpool, and reached the Mersey about 1 a.m. on Tuesday. A few hauls of the trawl and dredge were taken on the way home, with no great results, and the tow-nets, both bottom and surface, were worked whenever practicable.

The important feature of this cruise, however, was the use which was made of the electric light for collecting after dark. On the first night, in Ramsey Bay, after the shore party had left and the ship was anchored for the night, an electric light of 1000 candle-power was hoisted a few feet above deck, and this allowed work to be carried on almost as comfortably as during the day. Captain Young, of the Liverpool Salvage Association, who was in command of the *Hyæna*, then kindly arranged for me a 60 candle-power Edison-Swan submarine incandescent lamp in the mouth of a tow-net. This illuminated net was carefully let down to a depth of 3 fathoms, and allowed to remain there for half an hour. At the same time, another tow-net without any light was let down to the same depth over the opposite side of the ship. When the nets were being hauled in, as the one with the electric light approached the surface numerous small animals (Crustacea probably) were noticed accompanying it, and darting about in the bright light. This tow-net, when emptied into a glass jar of sea-water, was found to contain an abundant gathering, consisting mainly of Crustaceans; while the net in the dark on the other side of the ship had practically nothing.

The two nets were then put out again. The one had the electric light in its former position, but this time it was let down to the bottom at a depth of 6 fathoms; while the other net was placed in the dark at the ship's stern, and also reached the bottom. The tow-nets remained stationary, but were kept distended by the tide. The outline of the illuminated net could be made out indistinctly at a depth of 6 fathoms. After being out for three-quarters of an hour, both nets were hauled in, with the same result as before. The illuminated net contained abundance of Crustacea (chiefly Amphipoda, Schizopoda, and Cumacea), while the dark net again contained practically nothing. These two experiments showed pretty conclusively the effect of the brilliant light in attracting the free-swimming animals, the difference between the contents of the two nets being on both occasions most marked. Consequently, on the second night, in Port Erin Bay, *both* nets were illuminated, and while the one was let down close to the bottom, at a depth of 5 fathoms, the other was kept at the surface of the sea on the opposite side of the ship. This experiment was tried three times, with the same result each time: both the nets were found to contain abundance of animals, but the bottom and surface gatherings differed greatly in appearance and in constitution. The net from the bottom contained mainly large Amphipoda, and some Cumacea, while the gathering from the surface was characterized by the abundance of Copepoda. As Mr. A. O. Walker, who is reporting upon our higher Crustacea, pointed out to me, the Amphipods from the deep net appeared to be chiefly red-eyed species, such as *Ampelisca lævigata* and *Bathyporeia pilosa*. If this, on a detailed examination of the material, turns out to be the case, it may indicate an interesting relation between the colour of the eyes and sensitiveness to the electric light.

Mr. Thompson has already identified the following species of Copepoda from the illuminated surface net: *Calanus finmarchicus*, *Pseudocalanus elongatus*, *Dias longiremis*, *Idya furcata*, *Centropages hamatus*, *Anomalocera patersonii*, *Isias clavipes*, *Oithona spinifrons*, *Harpacticus chelifer*, and *Harpacticus fulvus*. The specimens of the last two species are remarkable for their unusually large size and their abundance.

The various groups of animals collected will as usual be worked up in detail by specialists, and the results will appear in future L.M.B.C. Reports; but the application of the electric light to marine biology, as a bait or attraction in the tow-net worked after dark, seems of sufficient importance to warrant the publication of this preliminary account of the results of the *Hyæna* cruise of Whitsuntide 1888. The obvious extension of this illumination method to deep-water tow-netting and trawling during the day-time I hope, thanks to the kindness of the Salvage Association, to be able to experiment upon in a future expedition.

W. A. HERDMAN.

A REMARKABLE CASE OF FASCIATION IN FOURCROYA CUBENIS, *HAW*

THERE was lately exhibited in this city a plant of *Fourcroya cubensis*, Haw., in which the well-known, tree-like inflorescence had been deformed into what I believe to be the largest fasciation on record. The plant came from Carapa, a small village distant about 4 miles towards the west from Caracas. Its aspect is given in the accompanying figure, engraved after a photograph.

The stem of the plant, covered by the leaves, is about 1 metre in height. From between the upper leaves there branch out two flattened and curiously twisted bodies. The one to the left was soon checked in its growth, so that it forms but little more than a semicircle; whilst the other, after having described a curve somewhat like a very large capital S, rises to a height of about 4 metres from the soil. Both together have in the front view the appearance of a small boat with hoisted sail filled by the wind. The under and lower parts of this deformed flower-stem are covered by numerous bracts, and measure 80 centimetres in their greatest breadth. Towards the top it divides into shred-like branches bearing flower-buds; those of the latter I examined being in every respect of normal structure.

There can be little doubt that, in this case, the malformation is due to some injury done to the young flower-

stem, when it was scarcely 1 foot high, vestiges being still visible that it was bent towards the right and kept in this forced position by some of the leaves. The upward growth being thus checked, numerous adventitious buds made their appearance on the injured organ, coalesced from the very outset, and formed by their subsequent growth the fasciated stem, the twisting resulting from the unequal rate of development of its component parts (Masters, "Veget. Teratology," 18).

Fasciation is likely to be not at all uncommon in *Fourcroya* and other allied plants, though I know of but three cases in the former, and never heard of any in *Agave*. In 1854 a very curious case of this kind was for several months the cause of considerable excitement among the good people of Caracas; it is described in the newspapers of the time as having been likewise twisted in the shape of a gigantic S. Another instance came under my notice in 1876, and was described in the *Journal of Botany* of that year, p. 180.

Caracas, April 19. A. ERNST.

NOTES.

THE following were elected Foreign Members of the Royal Society, on Thursday, May 31: Prof. Edmond Becquerel, of Paris, distinguished for his researches on the effects of light on bodies, especially with reference to phosphorescence; Prof. Hermann Kopp, of Heidelberg, for his researches on atomic volumes and boiling-points; Prof. Eduard F. W. Pflüger, of Bonn, for his researches in physiology, especially in relation to irritability of nerves, respiration, and animal heat; and Prof. Julius Sachs, of Würzburg, for his researches in botany, especially vegetable physiology.

THE Board of Visitors made their annual inspection of the Royal Observatory at Greenwich on Saturday last.

THE Vienna Correspondent of the *Times* announces that, in pursuance of a resolution passed at a recent meeting, the Vienna geologists will invite the International Geologists' Congress, which will assemble in London in September, to hold its next meeting in Vienna.

AT a recent meeting of the Victoria Royal Society, the President (Prof. Kerrot) announced that the first meeting of the Australian Association for the Advancement of Science would be held at Sydney, beginning September 4, the second at Melbourne, the third at Adelaide. The proposal that Victoria should join in the movement was favourably received, but at that meeting no action was taken in the matter.

IT will be seen from our list of the additions to the Zoological Society's Gardens during the past week that a living specimen of Pallas's sand grouse (*Syrrhaptes paradoxus*), the new visitor from Central Asia, has been presented by Mr. H. Hewart Crane, of Berwick-on-Tweed. It was captured at that place on May 25.

THE Tartar sand grouse seems to have appeared in Denmark and Scandinavia before making its appearance here. In the Island of Bornholm, in the Baltic, large flocks, numbering many hundreds, were seen early in May, some being shot, others captured alive. A few days later, birds were seen in various parts of Denmark and Sweden. In Norway a flock of birds was seen at Lister, on the extreme west coast, on May 12, and two were shot, a male and female. Their crops were full of tiny black seeds unknown to that country, whilst the eggs in the hen were far developed. During the immigration in 1863 these birds were seen as far north as Nordfjord. In that year, too, many nested on the west coast of Jutland, where the soil is sandy, but they were all gathered by the fishermen.

PROF. A. GRAHAM BELL, who is now on his way to England, will shortly appear before the Royal Commission engaged in making inquiry as to the best methods of caring for and educating deaf-mutes. In announcing this fact, *Science* reminds its readers that several years ago Prof. Bell presented a paper, at a meeting of the National Academy of Sciences, on the formation, through the intermarriage of deaf-mutes, of a deaf variety of the human race, and gave some important statistics to show that a much larger percentage of the children of deaf parents are deaf than of those whose parents possess the sense of hearing. This paper attracted wide attention, and gave rise to very interesting discussions both in America and elsewhere. The Royal Commission has requested Prof. Bell to lay before it the results of his subsequent investigations and studies upon this branch of the subject, and he has devoted much time to the preparation of facts and figures in regard to it. He will also give the Commission the result of his studies of other divisions of the subject.

ACCORDING to *Allen's Indian Mail*, Mr. Barrington Browne, the geologist sent by the Secretary of State to examine the Burma Ruby Mines, has left Simla for England. He has, it is understood, handed in to the Government of India his report on the mineral wealth of Upper Burma.

THE hydrographic survey of Canadian waters, which has already taken about five years, is now nearly half done. Commander Boulton is hard at work in Georgian Bay, one of the most dangerous of inland waters in Canada, and it is said that the survey will be extended to Lake Superior.

FROM September 15 to October 25 there will be in Vienna an International Exhibition of Amateurs' Photographs and Photographic Apparatus. The Exhibition is being organized by the Vienna Club of Amateur Photographers, and will be held in honour of what is called "the Jubilee" of the Emperor Francis Joseph. It will include every branch of art and manufacture connected with photography. The Club's Daguerre Medal and

certificates of honourable mention will be awarded to the best exhibit or exhibits in each class of photography, photographic apparatus, lenses, &c., provided the jury deem any exhibit or exhibits of sufficient merit. From the decision of the jury there will be no appeal. The Club, as far as its funds permit, will purchase the most interesting exhibits. Amateurs have not to pay hire for the space allotted to them. On application they can obtain the use of frames free of charge. A catalogue will be published, possibly with illustrations of the most interesting objects. According to the statutes of the I. and R. Austrian Museum for Arts and Manufactures, admission will be free five days a week.

THE current number of the *Board of Trade Journal* contains an abstract of the third volume of the Reports of the Royal Commission appointed by the King of the Belgians in April 1886 to inquire into the condition of labour in Belgium. The volume contains the propositions of the various sections of the Commission with respect to the different questions relating to the condition of the working classes, and also the final conclusions of the whole Commission. The third section of the Commission dealt with technical education, and the conclusions adopted by the whole Commission are as follow:—(1) They recommend that in the technical schools practical lectures be given on the application of art and science to industry. (2) Manual dexterity should be cultivated in the elementary schools. At the industrial schools the theoretical application of science to industry should be taught. (3) The Government should limit its action to providing grants for these schools, and fixing the position each school is to occupy in a proper gradation of educational institutions. (4) The local bodies should introduce manual exercises into the primary schools, and found more technical schools and schools of design and modelling. (5) The aid of the Government and the communes should be given conditionally on a minimum age being fixed for apprentices, and on a test examination at entrance being made necessary. (6) The Government should aid in increasing the facilities by which workmen would get technical instruction in subjects suited to their occupation.

M. COUMBARY, Director of the Imperial Meteorological Observatory at Constantinople, has published a pamphlet upon the climatology of that place, deduced from twenty years' observations (1868–87). Hitherto, what has been known about its climate is mostly owing to observations and summaries contained in the periodicals of the French Meteorological Society, commencing with the year 1847, and to the telegraphic reports in the French *Bulletin International*. M. Coumbary issued a monthly Bulletin in 1869, containing observations made at several places in the Ottoman Empire, but this was discontinued in 1874. The present discussion shows that the mean temperature is 57°·7. The absolute maximum was 99°·1 in August 1880, and the minimum 17°·2 in January 1869, giving a range of 82°. The French observations show greater extremes, but this is probably owing to imperfect protection from radiation in earlier years. The greatest daily ranges were 37°·8 in December, and 36° in March; in other months the range has not exceeded 27°. The extremes are of course modified by the influence of the Black Sea; it is not unusual for the thermometer at Odessa, for instance, to indicate 24° or so below the temperature at Constantinople. The mean annual rainfall is 28 inches, and the days of rain average 84. Snow falls on 14 days, on an average. About three years ago the Sultan showed his interest in the subject by the establishment of a second observatory in his palace at Yildiz. Both institutions are furnished with the best instruments.

WE have received the twelfth Annual Report on the Meteorology of India, containing the observations taken in 1886. It deals with nearly the same area as last year, and is published in the form previously adopted. For fullness and thoroughness in the discussion of results, it remains unexcelled, and it includes, as before, monthly charts showing very clearly the mean pressure and temperature, and the resultant winds over the vast region embraced in the Report. Among the more important additions are an observatory at Mandalay, where the transitions of the seasons are said to be sudden, and earthquakes not infrequent, and a station on the Great Coco Island, in the Bay of Bengal, an island which is said to be destitute of drinking-water. The results show that in every month of the year 1886 the mean "equilibrium" temperature of insolation throughout India was below the average of the last ten or eleven years by amounts varying from 0°·8 to 1°·8. The annual variations for the past seven years show a fairly well-marked periodicity, and suggest a slight variation in the sun's radiating power. The rainfall is represented by 500 stations (14 more than in the previous Report), and was characterized by several striking features. On the mean of the whole area there was an excess of 2·77 inches as compared with the averages for previous years.

THREE important new chlorine compounds of titanium have been obtained by Drs. Koenig and von der Pfordten, of Munich. They may be considered as chlorine derivatives of titanic acid, $Ti(OH)_4$, and form the only complete series of such compounds with which we are as yet acquainted in the whole range of inorganic chemistry. They are formed by the replacement of the hydroxyl groups by chlorine, and have therefore the following constitutions: $TiCl(OH)_3$, $TiCl_2(OH)_2$, and $TiCl_3OH$. The well-known tetrachloride of titanium, $TiCl_4$, thus completes the series, and in reality formed the starting-point from which the three intermediate compounds were successively prepared. Trichloride of titanic acid, $TiCl_3OH$, was obtained by the careful addition of concentrated hydrochloric acid to the tetrachloride in such proportion that the amount of water present in the strong acid was that required by the following equation: $TiCl_4 + H_2O = TiCl_3OH + HCl$. The reaction is very violent, and a solid mass of the trichloride was almost instantly formed and considerably distended by the escaping hydrochloric acid gas. The substance was at once transferred to the vacuum of an air-pump, and after a few days was found to be entirely freed from last traces of the gas. The solid trichloride thus formed is extremely deliquescent, and readily dissolves with considerable hissing in water and alcohol, the aqueous solution being remarkably stable. The dichloride, $TiCl_2(OH)_2$, was prepared by addition of a slight excess of strong hydrochloric acid to the tetrachloride, and also by placing the latter compound in a small quantity of ice-cold water. In the latter case, the drops of $TiCl_4$ are at first decomposed with loud hissing, which, as the drops continue to fall, gradually diminishes until a point is reached when a drop floats on the surface and remains unattacked. This last drop is then removed, and the clear solution evaporated *in vacuo*, when the dichloride is left as a compact deliquescent solid. The monochloride, $TiCl(OH)_3$, is the product of the action of moist air upon the tri- and di-chlorides, hydrochloric acid gas being at the same time evolved, in accordance with the following equations:

$$TiCl_3OH + 2H_2O = TiCl(OH)_3 + 2HCl,$$
$$TiCl_2(OH)_2 + H_2O = TiCl(OH)_3 + HCl.$$

The monochloride thus formed remains stable in air; on evaporation over oil of vitriol it is obtained as a white solid, crystallizing apparently in the hexagonal system, and very difficultly soluble in water. In conclusion, the Munich chemists show very conclusively that these new substances are true compounds and no mere mixtures; and, it may be added, the analyses, which must of necessity have been extremely difficult, are quite satisfactory.

THE British Consul at Mogador, in Morocco, in his last report notes, in connection with the fisheries of the year, a curious

phenomenon. A fish locally called the "tasargelt" (*Temnodon saltator*) has appeared in vast shoals, having left the waters unvisited, save a few stray specimens, since 1859. It weighs from six to eight pounds, and has flesh of rich flavour, of which the natives never seem to tire. It first appeared in large numbers early in September, and from that time till December the fishermen were busily occupied taking them. The mode of capture is rather primitive. A piece of white rag or a strip of the skin of the tasargelt itself is fastened to a large and often barbless hook, which in turn is tied by strong brass wire to the end of a short bamboo rod. When the bait is drawn rapidly through the water, the fish rises quickly to it. The tasargelt was accompanied by shoals of the "azlimzah" or "maigre," a fish which frequently weighs as much as sixty or seventy pounds. The presence of these voracious fish ruined the ordinary hook-and-line industry. Though shoals of bonito appeared, only one small specimen was taken, for they refused to take any bait. The sardine fishery was also a failure.

THE British Consul at Varna, in the course of his Report on the trade of his district for the past year, refers to the vineyards, and says that, though the Phylloxera has not made its appearance in these regions, there is a kind of insect pest which he believes to be peculiar to the Varna vineyards. Its ravages have been confined to certain areas, and the vine it attacks is disabled only for the year of the attack, and only to the extent of the particular shoots which it may lop off. The local name of the insect is *Kara terzi*, or "the black tailor," an appellation which is supposed to indicate its appearance and habits. In the absence of local entomologists, Mr. Brophy describes this new pest as an adipose black beetle, somewhat resembling the ordinary dung-beetle, measuring, when adult, about three-fourths of an inch in body-length, and furnished with a short pair of shears; with these, in the mornings of April and May, it cuts through and off the young vine-shoots, which it leaves on the ground until they are parched by the sun, when it drags them into the recesses of its deep and tunnelled hole, generally situated at the foot of the plant attacked. The vineyards chiefly affected are situated on ground near the sea-shore, whence the insect makes its way inland; "and as the *Kara terzi* does not appear to have obtruded itself upon the notice of the vine-growers by its obnoxious habits until comparatively recently, it may perhaps be fair to suppose that the temptation of green and succulent vine-shoots may, in the course of generations, have perverted the present race into abandoning the more innocent diet which satisfied their ancestors, and which, when the vine-shoots have passed the tender stage, has still to suffice those of the present day." Mr. Brophy says that if the circumstances of insect-life here related prove in any way new or interesting, it would not be difficult to procure, in summer, specimens of this beetle for inspection by qualified entomologists.

AT two successive meetings of the Oriental Society of Pekin, Prof. Russell, of the Tung-Wen-Kwan, or Foreign Language College, read two papers on subjects connected with Chinese astronomy. In the first he described the instruments in the Pekin Observatory, which were constructed by the order of the great Emperor Kanghi about 1670. In the course of the discussion which followed, it was stated that this prince was very fond of mathematics and astronomy, and that the present Emperor was credited with similar inclinations. Kanghi was sixteen when he ordered the instruments to be constructed. The clepsydra used in the Observatory, it was stated, consisted of five cisterns, and was used for observing the time of eclipses, being put in order for this purpose three days before each eclipse. One of the instruments is usually said to be of European design and to have been presented by Louis XIV. The inscription or emblem on it has been carefully removed, and its place supplied by a piece of bronze matching the metal of the instrument. In some Chinese books it is said that this instrument was manfactured by a foreign priest. Verbiest, a Jesuit of the time of Kanghi, pointed out a mistake in the Chinese calendar; the matter was referred by the Emperor to the Board of Astronomy, and Verbiest's accuracy was acknowledged. From that time a Jesuit missionary occupied the post of Vice-President of the Board down to 1828.

THE second paper, also by Prof. Russell, was on early Chinese eclipse calculations, and entailed vast labour in re-calculating. It appears from the investigations of the learned Professor that the earliest calculations of a solar eclipse and also of a lunar eclipse which have been preserved were made by the Chinese. The discussion turned largely on the historical value of the Chinese classics with regard to these astronomical observations, and the attention with which the Chinese from the earliest times have studied astronomy. Passages found in one or other of the few works which survived the destruction of the books before the Christian era bear witness to the devotion with which the stars were studied in China at that remote epoch. The full text of these two interesting papers will be awaited with interest.

AT a recent meeting of the Scientific Society of Upsala, Dr. C. Aurivillius read a paper on the skeleton of the so-called Swedenborg whale (*Eubalena swedenborgii*, Lillj.), discovered last November in the province of Halland, in a layer of marl 50 feet above the sea. Remains of this species of whale have only been found once before, viz. early last century, when some parts of one were discovered in the province of Western Gothland, 330 feet above the sea, and 70 miles inland. It was at first believed that they were the bones of some giant, but it is said that Swedenborg discovered their true nature. The skeleton has been presented to the Upsala Museum.

IN the Proceedings of the Moscow Archæological Society, there is a most interesting communication by M. Anutchin, on the use of sledges, boats, and horses, or saddles, at the burials of various races. He shows that until the seventeenth century the Slavonians used sledges even in summer for the transport of the corpse to the grave. The Samoyedes and Ostyaks, and many Russian peasants of Northern Russia, still follow this custom. The boat was used by the Normans, the Old Germans, and generally by races inhabiting the shores of lakes. Many tribes of North America used to bury their dead together with a horse, or transported the dead to the grave on a horse. It is remarkable that the same custom is found among the Lithuanians, who, even in the sixteenth century, put their dead on a saddle. The sledge, the boat, and the horse, or saddle, were obviously intended to aid the dead in passing into another world, and in visiting kinsfolk there.

AN ancient canoe has been found in the Tunhövd Fjord, in Valders, in South Central Norway. It has been hollowed out by means of red-hot stones, and is 4½ metres long and 80 centimetres broad. It is in fair condition. The find is of interest, as no other primitive vessel of the kind has been found inland in Norway. The boat will be sent to the Museum at Christiania.

Science says that a citizen of the United States, who has long resided abroad, proposes to give to the Smithsonian Institution a large collection of armour from the Middle Ages—some of it connected with most famous historical names—including horse-armour, helmets, swords, and all the paraphernalia of ancient warfare. These objects, numbering about five thousand, have been brought together at great expense, and the collection is one of the most valuable of the kind in the world. The condition of

the presentation is that the Smithsonian Institution shall furnish a fire-proof building for the collection.

AT the last meeting of the Ceylon Branch of the Royal Asiatic Society, a lengthy paper was read by Mr. P. Ramanathan, the leading Tamil of Colombo, on the ethnology of the Moors of Ceylon. These Moors, or Moormen, are usually classified in the island as a race by themselves, apart from the Tamils, Singhalese, and other races inhabiting it, but Mr. Ramanathan came to the conclusion that the history, social customs, physical features, and language of the Moors, class them as Tamils who were converted to Mohammedanism in India before their migration to Ceylon. He does not think there is any difference between the two classes of "Ceylon Moors" and "Coast Moors" in race or in the history of their conversion, the difference drawn by the members of these classes between themselves being due to a break in the course of immigration from India caused by the persecution of Mohammedans by the Dutch when the latter had possession of Ceylon. He pointed out that it was impossible that the very large number of Moors now existing in India and Ceylon could be, as is popularly supposed, descendants of the small bands of Arab and Moorish merchants and refugees who visited India in early times. He thought that only about 5 per cent. of the existing Moors could owe their origin to these immigrants. The paper, which was a very long and exhaustive one, evidently could not be fully appreciated by those who merely heard it read; but in the subsequent discussion most of the speakers appeared to think that Mr. Ramanathan's conclusion was not satisfactorily established. It was argued that in several directions—especially in regard to the shapes of the skulls—the facts were insufficient, and that at best Mr. Ramanathan's evidence for his thesis was only secondary. The value of the paper as a starting-point for further investigation was generally acknowledged.

THE *Comptes rendus* of the French Academy of Sciences for May 14, publishes some interesting remarks on the vital statistics of Germany, by M. Ch. Grad, author of a work on the power and resources of the German people. The population of the empire increased from 40,816,000 in 1870 to 46,855,000 in 1885; that is, an increase of over 6,000,000 in fifteen years, or at the rate of 1 per cent. per annum. Compared with this the increase in France has been extremely slow, less than 5,000,000 for the period of fifty years between 1831 and 1881 (32,560,000 and 37,321,000 respectively), or at the rate of only 0·3 per cent. per annum, with a constant tendency to diminish. During the last fifteen years the excess of births over deaths has been seven times greater in Germany than in France. The contrast becomes greater when it is added that, while few Frenchmen emigrate, as many as 4,000,000 Germans have removed to the United States since 1820. In 1880, the population of the empire included 2,860,000 of Polish speech, 300,000 of French, 150,000 of Danish, 150,000 of Lettish, 137,000 of Wendish, and 34,000 of Checkish or Bohemian. But on the other hand there are at present in Europe over 60,000,000 of Germanic speech, if the 8,000,000 Dutch and Flemish speaking inhabitants of the Low Countries be included. Altogether, the Teutonic nationality has doubled in Europe since 1840. But the increase has been almost entirely in the urban population, which advanced from 14,790,000 in 1871 to 18,720,000 in 1880, while that of the rural districts remained almost stationary (26,219,000 and 26,513,000 respectively). For the whole empire the density of the population is about 86 per square kilometre as compared with 72 in France.

SOME figures with reference to alcoholism and criminality were recently communicated to the French Academy of Medicine by M. Marambat. They referred to an examination of 3000 condemned persons; and it appears that 79 per cent. of the vagabonds and mendicants were drunkards, 50 to 57 per cent. of assassins and incendiaries, 53 per cent. of persons convicted of outrages on morals, 71 per cent. of thieves, sharpers, &c. In acts of violence against the person, 88 per cent. were found to be drunkards; against property, 77 per cent. Among youths under twenty, drunkards were nearly as numerous as among adults, the difference being only 10 per cent. Of these youths, 64 per cent. were addicted to drinking. An examination of the departments showed the largest number of drunkards from the regions where spirits are most largely consumed.

A FIFTH edition of the late Prof. Balfour Stewart's "Elementary Treatise on Heat" (Clarendon Press) has just been issued. Prof. Tait undertook to read the proofs, but found that there was little for him to do. "Prof. Balfour Stewart had himself," he says, "given *imprimatur* to all but the last six sheets; and for these I was furnished with 'copy' (excepting four pages) fully revised and initialed by him. The book is published, therefore, precisely in the form in which its author intended it to appear."

THE February and May numbers of the Journal of the Anthropological Institute are of more than usual interest. Among the contents are the following papers: on an ancient British settlement excavated near Rushmore, Salisbury, by General Pitt-Rivers; on the stature of the older races of England, as estimated from the long bones, by Dr. John Beddoe; the Lower Congo, a sociological study, by Mr. R. C. Phillips; the origin and primitive seat of the Aryans, by Canon Isaac Taylor; the Maori and the Moa, by Mr. E. Tregear; on the shell money of New Britain, by the Rev. Benjamin Danks; on tattooing, by Miss A. W. Buckland; on the evolution of a characteristic pattern on the shafts of arrows from the Solomon Islands, by Mr. Henry Balfour; on the occurrence of stone mortars in the ancient (Pliocene?) river-gravels of Butte County, California, by Mr. Sydney B. J. Skertchly; and the address delivered by Mr. F. Galton, as President, at the anniversary meeting of the Institute.

MESSRS. JOHN WILEY AND SONS, the American publishers, have in preparation a translation of Rosenbusch's "Microscopical Physiography of Minerals and Rocks," by Joseph P. Iddings, of the United States Geological Survey.

LAST week we referred to the edition of Barlow's Tables of Reciprocals issued by Taylor and Walton in 1840. The work has also been issued by E. and F. N. Spon. With reference to our note on this subject, Mr. V. B. Sprague and Mr. George King call attention to the "Table of the Reciprocals of Numbers from 1 to 100,000, with their differences, by which the reciprocals of numbers may be obtained up to 10,000,000, by Lieut.-Colonel W. H. Oakes, A.I.A. London: Charles and Edwin Layton, 150 Fleet Street, 1865." This table gives to seven significant figures the reciprocals of all numbers from 10,000 up to 99,999; and by means of the proportional parts the reciprocals of all numbers up to 10,000,000 may be obtained. Mr. Sprague points out that reciprocals can also be obtained with great facility by the use of Thomas's arithmometer; and this, he thinks, is the most convenient method when the number contains eight digits, and it is desired that the reciprocal should contain the same, or a larger number, of significant figures.

A RUSSIAN translation of Prof. Everett's "Units and Physical Constants" has just been published at St. Petersburg. This is the fifth language into which the work has been translated, the other four being Dutch, French, Polish, and German. The German edition was long delayed by the compiling of additional experimental data, and only made its appearance a month ago.

THE New York State Museum of Natural History has issued a useful Bulletin (No. 3) on "Building-Stone in the State of New York." The author is Mr. John C. Smock.

THE additions to the Zoological Society's Gardens during the past week include a Pudu Deer (*Pudu humilis* ♀) from Chili, presented by Mr. G. E. Pugh Cook; two —— Squirrels (*Sciurus* ——) from Demerara, presented by Mr. R. Forrester Daly; a Blue and Yellow Macaw (*Ara ararauna*) from South America, presented by Mrs. Alfred Palmer; a Pallas's Sand Grouse (*Syrrhaptes paradoxus*) from Berwick-on-Tweed, presented by Mr. H. Hewart Crane; two Australian Waxbills (*Estrelda temporalis*); seven Spotted-sided Finches (*Amadina lathami*) from Australia, presented by Mr. David S. Hodge; a Nose-crested Iguana (*Iguana rhinolopha*) from St. Lucia, West Indies, presented by Dr. T. Dennehy; a Tent Tortoise (*Testudo tentoria*), a Fisk's Tortoise (*Testudo fiski*) from Cradock, Cape Colony, a Dwarf Chameleon (*Chamæleon pumilus*), a Purplish Gecko (*Phyllodactylus porphyreus*), a Hoary Snake (*Coronella cana*), three Narrow-headed Toads (*Bufo angusticeps*), five Gray's Frogs (*Rana grayi*) from South Africa, presented by the Rev. G. H. R. Fisk; two Tigers (*Felis tigris*) from India, two Puff Adders (*Vipera arietans*) from South Africa, deposited; a Long-billed Butcher Crow (*Barita destructor*) from New Holland, received in exchange; two North African Jackals (*Canis anthus*), born in the Gardens.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1888 JUNE 10–16.

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on June 10

Sun rises, 3h. 46m.; souths, 11h. 59m. 15·5s.; sets, 20h. 13m.: right asc. on meridian, 5h. 16·3m.; decl. 23° 4′ N. Sidereal Time at Sunset, 13h. 31m.

Moon (New on June 9, 17h.) rises, 4h. 35m.; souths, 12h. 40m.; sets, 20h. 49m.: right asc. on meridian, 5h. 57·3m.; decl. 20° 45′ N.

Planet.	Rises.	Souths.	Sets.	Right asc. and declination on meridian.
	h. m.	h. m.	h. m.	h. m. ° ′
Mercury..	5 25 ...	13 46 ...	22 7 ...	7 3·0 ... 24 0 N.
Venus.....	3 18 ...	11 22 ...	19 26 ...	4 39·5 ... 21 45 N.
Mars.....	14 0 ...	19 34 ...	1 8*...	12 52·2 ... 5 45 S.
Jupiter....	18 7 ...	22 29 ...	2 51*...	15 48·4 ... 19 3 S.
Saturn....	7 15 ...	15 7 ...	22 59 ...	8 24·9 ... 19 55 N.
Uranus...	13 51 ...	19 31 ...	1 11*...	12 49·5 ... 4 35 S.
Neptune..	2 53 ...	10 38 ..	18 23 ...	3 54·9 ... 18 41 N.

* Indicates that the setting is that of the following morning.

June. h.

11 ... 21 ... Mercury in conjunction with and 2° 29′ north of the Moon.

12 ... 2 ... Mercury at greatest elongation from the Sun 24° east.

13 ... 8 ... Saturn in conjunction with and 0° 20′ north of the Moon.

Variable Stars.

Star.	R.A. h. m.	Decl. ° ′		h. m.	
U Cephei	0 52·4 ...	81 16 N. ...	June 10,	23 55	*m*
			,, 15,	23 35	*m*
S Cassiopeiæ ...	1 11·4 ...	72 1 N. ...	,, 16,		*M*
η Geminorum ...	6 8 1 ...	22 32 N. ...	,, 15,		*M*
V Geminorum ...	7 16·9 ...	13 18 N. ...	,, 11,		*M*
U Monocerotis ...	7 25·5 ...	9 33 S. ...	,, 16,		*M*
S Geminorum ...	7 36·3 ...	23 43 N. ...	,, 14,		*M*
δ Libræ	14 55·0 ...	8 4 S. ...	,, 15,	2 54	*m*
U Ophiuchi... ...	17 10·9 ...	1 20 N. ...	,, 13,	0 34	*m*
W Sagittarii ...	17 57·9 ...	29 35 S. ...	,, 12,	2 0	*M*
β Lyræ...	18 46·0 ...	33 14 N. ...	,, 16,	1 0	*m*
η Aquilæ	19 46·8 ...	0 43 N. ...	,, 12,	21 0	*M*
S Sagittæ	19 50·9 ...	16 20 N. ...	,, 10,	22 0	*m*
			,, 13,	22 0	*M*
X Cygni	20 39·0 ...	35 11 N. ...	,, 12,	21 0	*M*
T Vulpeculæ ...	20 46·7 ...	27 50 N. ...	,, 10,	22 0	*m*
R Vulpeculæ ...	20 59·4 ...	23 23 N. ...	,, 16,		*m*

M signifies maximum; *m* minimum.

Meteor-Showers.

	R.A.	Decl.	
Near α Vulpeculæ	286°	24° N.	Rather slow.
,, α Cephei ...	316	60 N.	Swift, streaks.
,, β Piscium ...	345	1 N.	June 11–13. Very swift.

GEOGRAPHICAL NOTES.

MAJOR HOBDAY reports of the operations in Upper Burma that during the season of 1887–88, the whole of the Yaw country has been thoroughly surveyed by surveyors attached to the various columns converging on Gangaw. On the north a connection has been made with the work executed by Colonel Woodthorpe's party last year in the Kubo Valley. A good deal of the geography of the Schwele River and the Mohlaing district has also been obtained. The extent of surveying that has been done by the surveyors who accompanied the column from Bhamo to Mogdung and thence by the Jade Mines and Endawgyi Lake to Katha, on the Irrawaddy, is not yet known, as reports have not yet been received. In the Southern Shan States a party under Lieut. Jackson, R.E., has carried on survey operations in continuation of last year's work from Fort Stedman to Pekon, in the Saga Valley, thence *viâ* Maukme, and Moné to Maing-pan and the Salween River, where the Siamese mission under Mr. Archer was met. Returning to Moné, they carried the survey through Legya and Bansan to Maing-ye. In the Northern Shan States a sub-surveyor has carried our surveys from Thibaw to Namsan, and across the Myit-nge or Namtu River to Theinni, on the Salween, and thence *viâ* Maing-yaw to Manse and Maing-ye, thus effecting a junction with Lieut. Jackson's work. Major Hobday himself has extended the triangulation from Kyan Nyat to Bhamo, of which the position is thus determined, and a basis provided for the surveys in the direction of Mogaung. It is hoped that the triangulation executed by this party will be connected during this season with that of the surveys in Lower Burma. In addition to the work done by members of this department, many reconnaissances have been executed by regimental and other military officers and the results given to Major Hobday for incorporation in his sheets.

WE are glad to notice that Signor Guido Cora's *Cosmos* now appears more regularly and frequently than formerly. The last number contains a detailed account of recent Danish expeditions in Greenland.

THE whole of the new number of the *Deutsche Geographische Blätter* is occupied with the narrative of J. G. Kohl's American studies, the results of journeys made thirty years ago in North America.

THE principal paper in the new part of the *Zeitschrift* of the Berlin Geographical Society is an elaborate examination of Sir John Mandeville's writings by Dr. A. Bovenschen, in which the author comes to conclusions decidedly unfavourable to Sir John's trustworthiness. Dr. G. Hellmann contributes an important paper on the rainfall of the Iberian peninsula. In the *Verhandlungen* of the same Society we find papers on the geography and ethnography of Southern Mesopotamia, by Dr. B. Moritz, and on the Isthmus of Corinth, by Dr. A. Philippson.

IT may be useful to state that in No. 1 of the third series of the *Bulletin* of the Egyptian Geographical Society is a connected account in French, by Dr. O. Lenz, of his last journey across Africa.

THE June number of the Journal of the Royal Geographical Society contains the first part of Mr. D. W. Freshfield's paper on the Caucasus; it deals with Suanetia, and is illustrated with maps and diagrams. The same number contains Mr. Woodford's paper on his explorations in the Solomon Islands.

TWO Swedish colonists, MM. Valdau and Knutson, have recently done some interesting geographical work in the Cameroons territory. M. Valdau has explored the northern slopes of the range, which are very thickly peopled by the Bomboko tribe. The main chain of the mountains does not extend as far as 4° 30′ N. lat., as the highest point attained by the traveller, about 4° 28′ N. lat., only measured 2850 feet. M. Knutson has explored the River Memeh, which, he ascertained, empties itself into the sea a little to the south of Rumbi. The river is navigable for thirty miles, to the Düben falls, which are 100 feet in height.

BIOLOGICAL NOTES.

FOSSIL FISH REMAINS FROM NEW ZEALAND.—Mr. Davis has recently described a number of fish remains from the Tertiary and Cretaceo-Tertiary formations of New Zealand. The memoir forms a part of the Transactions of the Royal Dublin Society, and is illustrated by seven well-executed plates of the fossils. Some short time ago Mr. Davis received the remains of some fossil Tertiary Elasmobranchs from Prof. F. W. Hutton, from New Zealand, which formed the subject of a short communication to the Geological Society of London; but a much larger collection having been in the meanwhile received, permission was granted for the withdrawal of the paper, and now, based on several additional collections, we have the present memoir, which for the first time does justice to these interesting fossil forms by full descriptions and excellent figures. The memoir opens with an account of the Tertiary formations of New Zealand, based on the results attained by the Geological Survey under Sir James Hector, while notice is taken also of the views of Prof. Hutton and Sir J. von Haast. In addition to the remains of fish, some Saurian teeth, as well as those of a Squalodon, have been found. Of the thirty-five species of fish described, no less than twenty-eight appear as new species; of these thirty-five, twenty-eight are Sharks, four are Rays, two belong to the Chimerids, and one to the Teleostei. A new species of toothed Whale, *Squalodon serratus*, is also described.—(Transactions of the Royal Dublin Society, vol. iv. (ser. 2), part i. pp. 1–50, plates i.–vii.)

MAMMALS OF LIBERIA.—Dr. F. A. Jentink continues his account of the recent zoological researches in Liberia, which have been carried on for the last seven or eight years by J. Büttikofer, C. F. Sala, and F. X. Stampfli. The amount of information collected by the first-named investigator is very great, and merits the high praise bestowed upon it by the Director of the Leyden Museum. Of the ninety species of Mammals sent home, thirteen belong to the Monkeys, eleven to the Carnivores, thirty-three to the Ruminants, five to the Pachyderms, twenty-five to the Rodents, one Sireniad, four Insectivores, seventeen to the Bats, and three to the Edentates. Among the more interesting species mentioned are the following: *Cercopithecus stampflii*, n. sp., from Pessy Country; *Terpone longiceps*, Gray; *Cephalophus doria*, Ogilby, and *Euryceros euryceros*, Ogilby; *Graphiurus nagtglasii*, n. sp.; *Claviglis crassicaudatus*, n. g. et n. sp.; *Crocidura buttikoferi*, n. sp., and *C. stampflii*, n. sp.; *Pachyura megalura*, n. sp.; *Epomophorus veldkampii*, n. sp.; and *Vesperugo stampflii*, n. sp. This number also contains notes of 151 species of Birds, collected by J. Büttikofer and F. X. Stampfli, during their last sojourn in Liberia. The last-named is still collecting on the Farmington River, a large confluent of the Junk.—("Notes from the Leyden Museum," vol. x. Nos. 1 and 2, January and April, 1888.)

ON NEW ENGLAND MEDUSÆ.—In a list of certain Medusæ, found by Mr. J. Walter Fewkes, off the coast of Maine and from Grand Manan, he redescribes and figures the interesting and beautiful *Nanomia cara*, A. Ag. This Physophore, described some twenty-five years ago, though repeatedly referred to in text-books and general works on zoology, seems to have since escaped attention, but many specimens were found at Grand Manan. It will be remembered that the form thought to be adult by A. Agassiz, is not above six inches in length, but Mr. Fewkes captured specimens measuring, when extended, over four feet in length, and three feet when retracted; while many hundreds were seen of the size of the specimen he figures, which is about sixteen inches long. When floating in the water they were easily distinguished from the southern Physophore, *Agalma elegans;* the nectocalyces are biserial, the specimen figured has thirteen pairs of well-developed bells, and many of the adults had fifteen pairs. Among the most interesting and it would seem exceptional structures in this form are the organs referred to by A. Agassiz as the "third kind of polyps," now called "hydrocysts" or "tasters"; these hang from the polyp stem midway between the polypites, a single adult and many half-developed tasters occurring between each pair of polypites. They are small, slender, flask-shaped bodies, the distal end is closed, and near the basal attachment there is a prominent red body of spherical shape, known as the "oil globule"; each taster has also a single long tentacle. Contrary to what A. Agassiz thought, the adult Nanomia has male and female bells on one and the same colony; each female bell carries a single ovum, which, when they escaped, could be easily seen by the unassisted vision. *Hydrichthys mirus*[1] is also described and figured as a new genus and species belonging to the Hydroida; it was found attached to the side of a small fish (*Seriola zonata*, Cuv.) which had been taken in the dip-net at a time when the sea was quiet. The patch had at first all the appearance of a Fungoid growth. The fish and Hydroid parasite were kept alive for some time in an aquarium, and from the latter many thousands of Medusæ were raised. The Hydroid colony formed a cluster of reddish and orange-coloured bodies; the basal attachment is a flat thin plate with ramifying tubes; upon it are separate clusters of gonosomes and (?) hydranths. Each gonosome is botryoidal; the free extremity of the gonosome is without tentacles, its rim is entire, and it is destitute of Medusa buds. It seems possible that no food is taken in by the gonosomes, but that the whole structure is dependent upon the tubes of the basal plate for its nutrition. The filiform structures (hydranths ?) are elongated flask-shaped bodies of about uniform size, with terminal openings. The Medusa is closely related to Sarsia, and so far shows the new Hydroid to be allied to the Tubularians, but there are not wanting certain features which hint at a kindred to the Siphonophores. The rare and interesting *Callinema ornata*, Verrill, is redescribed, and for the first time figured. With a remark of the author, "that histological researches lose some of their value if not preceded by an accurate identification or specific description of the animal studied, if it be different from known species," we heartily agree.—("Studies from the Newport Marine Laboratory," Bull. Mus. Comp. Anat. Harvard College, vol. xiii. No. 7, February 1888.)

THE BILL FOR THE PROMOTION OF TECHNICAL INSTRUCTION.

THE following is the Bill for the promotion of technical instruction, introduced by the Government:—

Be it enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

1.—(1) Any School Board in England may from time to time supply or aid the supply of such manual or technical instruction, or both, as may be required for supplementing the instruction given in any public elementary school in its district, whether under its own management or not.

(2) Manual or technical instruction shall not be supplied or aided under this section except for such scholars as—

(*a*) are recognized by the Education Department as in attendance at a public elementary school and receiving instruction in the obligatory or standard subjects prescribed by the minutes of the Education Department for the time being; and

(*b*) (in the case of technical instruction only) have obtained from the Education Department certificates of having passed the examination in reading, writing, and arithmetic, prescribed by the standard set forth in the schedule to this Act, or an examination equivalent thereto.

(3) For the purpose of supplying or aiding the supply of manual or technical instruction under this section, a School Board shall have the same powers, but subject to the same conditions, as it has for providing sufficient public school accommodation for its district, subject to this restriction that the amount of the rate to be levied in any one year for the additional purposes authorized by this section shall not exceed the sum of *one penny in the pound*.

2.—(1) If a School Board aids the supply of manual or technical instruction in any school or schools under its own management, it shall, on the request of the managers of any other public elementary school in its district fulfilling like conditions as to the supply of manual or technical instruction in conformity with the requirements of the Department of Science and Art, and on proof of sufficient demand for such instruction in that school, aid the supply of such instruction in that school in like manner as it aids such supply in the school or schools under its own management, subject to such terms as may be agreed on or determined in pursuance of this Act.

(2) If the managers of a public elementary school in the district of a School Board object to the terms on which the School Board proposes to aid the supply of technical instruction in that school, the Department of Science and Art shall, on the appli-

[1] *Vide* NATURE, vol. xxxvi. p. 604, where we believe this genus and species were first described by the author.

cation of those managers, determine whether the terms so proposed are reasonable.

3.—(1) Any local authority empowered to carry into execution the provisions of the Public Libraries Acts with respect to the establishment and maintenance of public libraries, public museums, schools for science, art galleries, and schools for art, may from time to time supply or aid the supply of technical instruction by providing or aiding in the provision of teachers, apparatus, or buildings to such extent and on such terms as the authority think expedient, and may exercise its powers under this section either with or without exercising any of its powers under the Public Libraries Acts.

(2) Provided as follows :—

(*a*) In a district for which there is a School Board, the local authority shall not out of their own funds supply or aid the supply of technical instruction suitable for scholars receiving at a public elementary school instruction in the obligatory or standard subjects prescribed by the minutes of the Education Department for the time being, except to the extent, if any, to which the authority was so supplying or aiding before the establishment of a School Board.

(*b*) In a district for which there is not a School Board, the managers of a public elementary school shall not receive aid under this section except for scholars for whom technical instruction may be supplied or aided by a School Board in a district for which there is a School Board.

(3) The amount of the rate to be levied in any one year under the Public Libraries Acts as amended by this Act for the additional purposes authorized by this section shall not exceed the sum of *one penny in the pound*, and where the powers given by the Public Libraries Acts are exercised concurrently with the powers given by this section shall not exceed *twopence in the pound*.

4.—(1) The managers of any technical school in the district of a School Board or local authority may make an arrangement with the Board or authority for transferring their school to that Board or authority, and the Board or authority may assent to any such arrangement.

(2) The provisions of section twenty-three of the Elementary Education Act, 1870, with respect to arrangements for the transfers of schools, shall apply in the case of arrangements for the transfers of schools in pursuance of this section.

5.—Every minute of the Department of Science and Art with respect to the condition on which grants may be made for technical instruction shall be laid on the table of both Houses of Parliament within three weeks after it is made, if Parliament is then sitting, and if Parliament is not then sitting, within three weeks after the then next session of Parliament, and shall not come into operation until one month after being so laid.

6.—In this Act—

The expression "technical instruction" means instruction in the principles of science and art applicable to industries and in the application of special branches of science and art to specific industries or employments. It does not include teaching the practice of any trade or industry or employment, but, subject as aforesaid, includes instruction in the branches of science and art with respect to which grants are for the time being made by the Department of Science and Art, and any other form of instruction which may for the time being be sanctioned by that Department by a minute laid before Parliament and made on the representation of a School Board or local authority that such a form of instruction is required by the circumstances of its district.

The expression "technical school" means a school or department of a school which is giving technical instruction to the satisfaction of the Department of Science and Art.

The expression "manual instruction" means instruction in the use of tools and modelling in clay, wood, or other material.

The expression "the Education Department" means the Lords of the Committee of Her Majesty's Privy Council on Education.

The expression "local authority" means the Council, Commissioners, Board, or other persons or authority carrying into execution, or empowered to carry into execution, the Public Libraries Acts.

The expression "Public Libraries Acts" means the Public Libraries (England) Acts, 1855 to 1887, and the Public Libraries (Ireland) Acts, 1855 to 1884.

7.—This Act may be cited as the Technical Instruction Act, 1888.

SCHEDULE.

STANDARD.

Reading.—To read a passage from some standard author.

Writing.—A short theme or letter on an easy subject, spelling, handwriting, and composition to be considered. An exercise in dictation may, at the discretion of the inspector, be submitted for composition.

Arithmetic.—Fractions, vulgar and decimal, simple proportion, and simple interest.

AGRICULTURAL EDUCATION IN NORTHERN ITALY AND IN PRUSSIA.

MR. COLNAGHI, Consul-General at Florence, in the course of an elaborate Report on his district, refers at some length to agricultural education in the province of Florence. He describes especially the well-known "Academia dei Georgofili," the Tuscan Society of Agriculture, the Comizi Agrari, or Agricultural Boards, the Stazioni Agrarie, and also refers to the various institutes and schools which have been established of late years in the province. The "Academia dei Georgofili" of Florence was founded in 1753, and was the first Association of the kind formed in Italy to promote the science of agriculture. On the roll of the Academy are to be found the names of the most distinguished Italian agronomists, and the long series of its Transactions contains important papers on all points of interest connected with the agriculture of Tuscany.

The Royal Tuscan Society of Horticulture, which was established in 1854, now numbers about 700 members. Much useful work has been done by this body in encouraging the improved cultivation of fruit, vegetables, flowers, and ornamental places and by the holding of annual shows in Florence.

Each district of the province has its Comizio Agrario, the objects of which are to extend agricultural skill and knowledge, or encourage improvements, and to form a centre for the diffusion of information. The Comizi offer prizes for improvements in cultivation, hold Conferences on various subjects, and publish Bulletins containing much useful information on practical subjects. These bodies are supported by members' subscriptions, and by grants from the Minister of Agriculture and from the province. Besides the annual shows held at Florence, there are regional agricultural shows (Concorsi Agrarii Regionali), instituted by the Ministry of Agriculture and the Comizi Agrari, which are held at stated periods, and in which some five or six provinces are included. These larger shows have been useful in bringing agriculturists from various parts of the country together, showing the latest improvements in machinery, and in displaying the various products of the different districts.

At the "Stazione Agraria" of Florence, which is a branch of the Technical Institute, and is under the direction of Prof. Bechi, experiments are made on the culture and diseases of the vine, the olive, and other plants, and analyses are made of soil, minerals, water, wines, &c. Attached to the Stazione is an experimental farm six hectares in size, and also a Government depot of agricultural machinery.

There is also in Florence a Bureau of Agricultural Entomology, under Prof. Tragioni-Tozzetti, where great attention is paid to the Phylloxera. This Bureau is in fact the centre of information for the whole of Italy on entomological subjects.

For practical instruction the province contains the Regio Istituto Forestale (Vallombrosa), the Regia Scuola di Pomologia e d'Orticoltura (Florence), and the Scuole Agrarie of Castaletti, near Signa, and of Scandicci, in the immediate neighbourhood of Florence. The Forest Institute of Vallombrosa, now under the Presidency of Prof. Piccioli, who is assisted by eight professors, was founded in 1869, on the model of the forestry schools of France, Germany, and Austria, to supply a sufficient number of trained officers for the Department of Woods and Forests. From 1869 till the present time, 159 students have entered the school, and of these 136 have received diplomas. All of these have entered into the service of their native country, except one who was a Swiss. The course of study lasts three years, during which time instruction is given in forestry and kindred subjects, and in French and German. The limits of age at entrance are sixteen and twenty-two, and the annual charge for board, residence, and instruction is fixed at 700 lire. The State pays a portion of the cost of some of the students, and sometimes their respective provinces do so.

Attached to the Institute is a library of works on forestry, and also the requisite collections and instruments, both chemical and scientific. A nursery which contains nearly 450,000 plants, and which can supply annually nearly 100,000 plants of from three to five years old, is also annexed. There is also a small fish-breeding establishment, in which about 10,000 trout-fry are annually hatched, and placed in the neighbouring streams.

The Royal School of Pomology and of Horticulture was established in 1882, and is now under the direction of Prof. Valvassori. Its object is to train vegetable and fruit gardeners. The course lasts three years, and is both theoretical and practical. The age for the admission of pupils is from fourteen to seventeen, preference being given to the sons of the smaller farmers, and the charges are 25 lire per month, besides 20 lire for the purchase of gardening-tools, &c., and an entrance fee of 10 lire. There are five professors, with a censor and two gardeners, and at present the number of pupils is thirty-two. For practical instruction the school possesses an orchard, and kitchen and flower gardens.

The Agricultural Institute of Castaletti has been in existence since 1859, when it was founded by Commendatore Leopoldo Cattani-Cavalcanti. It is now under the direction of Signor Riccardi-Manelli. One section of the school was placed on the footing of a Government technical institute during the life-time of the founder; but this has now been changed by the present Director, because the school has for its object, not the production of engineers and surveyors, but of factors or agents and head gardeners. The course of instruction in this institution lasts for four years, and the age of admission is from eleven to fifteen. Of late the charges have been increased, and in consequence the number of students has fallen from seventy to fifty. The entrance fee is now 50 lire; board, lodging, &c., 165 lire for the first and second years, and 180 lire for the third and fourth years; and 8 lire in addition per month for washing. The institution is not self-supporting.

The Agricultural School of Scandicci was founded as recently as 1884 by Count Napoleone Passerini for charitable purposes, his own villa being given up to the work. It was first only a day-school, but this year boarders have been admitted, and there are now ten boarders and eight externs. The object of the institution is to make good managers of rural estates. The course of study lasts for three years; the ages of admission are from fifteen to eighteen; the entrance fee is 10 lire, boarders paying in addition 36 lire per month, and 2 extra for washing. There are in all seven professors and masters. There is an experimental farm of 100 hectares in extent attached to the school, and a good library, and zoological, mineral, and agricultural collections, a chemical laboratory, an apiary, and a pigeon-house. A meteorological observatory of the second class, affiliated to the Central Observatory at Rome, is also annexed. The diplomas awarded to the pupils at the close of their course of study are countersigned by a special delegate of the Government.

According to the Report recently presented to the Foreign Office by Sir E. Malet on agricultural education in Prussia, the State annually gives £49,625 for agricultural instruction in that country, and £38,401 to the veterinary Colleges. Out of the former grant are supported the two Agricultural Colleges of Berlin and Poppelsdorf, the Pomological Institutes of Proskau and Geisenheim, and a station near Wiesbaden for experiments in agricultural chemistry; and subsidies are given to various provincial schools which are supported by local Boards but inspected by the central executive of the province. At the two Colleges the education is mainly scientific and theoretical, the ordinary course consisting of two terms of six months each. At the end of each term the subjects of examination are the science of farming and planting, farm management, physics and chemistry, botany, zoology, animal physiology, mineralogy, and geology. On passing these examinations the students are entitled to diplomas of proficiency in agricultural science. Those who wish to become land-surveyors can proceed to a further course of two terms of six months each, in which the instruction given is of a most advanced kind, embracing mathematics, trigonometrical surveying, levelling, engineering, forestry, and plantation, the science of breeding and rearing cattle, dairy farming, mechanics and agricultural machinery, besides a course of law bearing on questions with which land surveyors have to do. According to the most recent report, the Berlin Agricultural College was attended by 98 students in the summer term, 12 of whom proceeded to the more advanced course, and in the winter term by 155 students, 27 of whom went in for the higher course. Poppelsdorf College was attended by 76 in the summer term, of whom 45 went on to the higher course, and in the winter term by 87, of whom 57 attended the larger course. With regard to the lower-grade schools receiving help from the grant in aid of agricultural education, 16 are intermediate schools which get £13,365 every year from the State. The school money varies from £3 5*s.* to £1 10*s.* per term of six months, and the subjects taught in these institutions comprise chemistry, mineralogy, physics, zoology, veterinary science, and farming. There are also numerous local winter elementary schools which supplement by theoretical training the practical teaching which the pupils have had in the fields in spring and autumn. £6648 is annually given to them.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—An examination will be held at Cavendish College on Tuesday, July 24, and following days, according to the results of which it is intended to award eight Scholarships of £30 a year, provided that candidates of sufficient merit present themselves. Candidates must be under eighteen years of age on October 1, 1888, and may offer for examination one or more of the following subjects: Classics, Mathematics, Natural Science, Modern Languages. The Scholars elected will be required to come into residence at Cavendish College in October 1888, and commence study for a Tripos or the Engineering course. Medical students may conveniently combine their medical work with the course for the Natural Science Tripos. It is also intended to offer in June 1889 three Scholarships of £30 to be competed for by students of the College who will then have resided not longer than one year. The College fee for board, lodging, and tuition, is £25 for each of the three University terms, and £15 for residence (optional) in the Long Vacation. For further information apply to the Bursar, Cavendish College, Cambridge.

In the paragraph last week about Prof. Darwin's lectures (p. 117), for "tin" read "sun."

SCIENTIFIC SERIALS.

Bulletin de la Société des Naturalistes de Moscou, 1887, No. 4.—On organic compounds in their relations to haloid salts of aluminium, by G. Gustafson (in German). In this second part the following conclusions are arrived at. The organic compounds undergo deep modifications in presence of the above salts. The reactions of addition are the chief ones, but the most interesting are those undergone by the aromatic hydrocarbons under the influence of chloride and bromide of aluminium; although most unstable, and therefore sometimes viewed as mere molecular compounds, they show a deep modification of the hydrocarbons from which they issue. They explain also the *rôle* of salts in organisms.—On the regeneration of lost organs in spiders, by V. Wagner (in French). This is the result of a double simultaneous process; the atrophy of the tissues belonging to the lost member, and the growth of the new one in the atrophied remnants of the old member. Both processes are described and illustrated.—Short notes on some (eighteen) Russian species of the genus *Blaps*, by E. Ballion (in German).—On two new Branchiopods from the Transcaspian region (*Apus haeckelii*, n. sp., and *Artemia asiatica*, n. sp.), by Dr. A. Walter.—Enumeration of the vascular plants of the Caucasus, by M. Smirnow (continued). The Ranunculaceæ are described; they contain ninety-eight species, belonging to seventeen genera, and out of them thirty-seven belong to the genus *Ranunculus*, and thirteen to that of *Delphinium*. The *Myosurus*, *Garidella*, *Caltha*, and *Actæa* number only one species each. The total number of Caucasian Phanerogams, according to Ledebour's "Flora Rossica," is 2965; now it must be estimated at about 4000 species. Out of the ninety-eight species of Ranunculaceæ described, forty belong exclusively to the flora of the East, while fifty-two are met with in South Russia, thirty in the Crimea, thirty-three in the Altai, twenty-four around Lake Baikal, and only twenty-one in the Urals, and eighteen in North Russia. Very interesting remarks follow as to the distribution of the Ranunculaceæ in separate parts of the Caucasus.

1888, No. 1.—Some remarks on the consequences of the earthquake of February 1887 in the Riviera, by H. Trautschold.—The chief noxious insects on tobacco in Bessarabia, an elaborate research by Prof. K. Lindeman. (Both papers in German.)—Count Alexis Razumovsky, first President of the Society, by Dr. Benzengre (in French).—List of plants of Tambof, by D. Litvinoff (continued).—On the hairs called auditive of the spiders, by W. Wagner (*Gehör-Organe* of Dahl). They belong to different types, and none of them can be recognized as performing the auditive function; they seem merely to be tactile organs of a higher structure.—Studies on the palæontological history of the *Ungulatæ*, by Marie Pavloff (second memoir). After having discussed the genealogy of the horse as viewed by V. Kovalevsky, Messrs. Marsh, Cope, Lydekker, Branco, and Schlosser, and discussed the rich material which Mrs. Pavloff was in possession of, the writer arrives at the following scheme. The eldest ancestors of the horse, *Phenacodus*, are found in the Eocene of North America; in Europe they are represented by the *Hyracotherium leporinum*, which, together with the *Pachynolophus* and *Anchilophus*, inhabited both continents. In the Miocene we find the *Anchitherium*, in America first, and later on in Europe; it was transformed in America into the *Protohippus* of the Mio-Pliocene. This last gave rise to the *Hippidium* and *Equus*, which largely developed during the Pliocene period in America (*E. parvulus*), Asia (*E. nomadicus*), Europe and Africa, where the *E. stenonis* was the ancestor of the Post-Pliocene *Equus caballus*. In how far our present horse originates from this later will be discussed next. Two plates illustrate the paper, written in French.

THE *Memoirs of the Odessa Society of Naturalists* (vols. xi. and xii.) contain the usual quantity of elaborate work, especially in anatomy and physiology. The papers on the embryogeny of the fresh-water lobster, by M. Morin; on the embryogeny of the Caucasian scorpion *Androctonus ornatus*, by MM. A. Kovalevsky and Shulghin; on the development of the *Urospora mirabilis*, by M. Woltke; on the embryology of the *Mysis chameleo*, by M. Nusbaum; and on the morphology of the *Haplotrichum roseum*, by M. Khmielevsky, are elaborate articles profusely illustrated by excellent plates.—M. Krasilschik's researches on the structure and life of the *Cercobodo laciniægerens*—a new genus of the Flagellatæ—are most interesting, showing how this microscopic organism preys on Bacteria and digests them, and how complicated is its organization altogether.—The same author contributes an interesting paper on the parasite Fungi of insects, and M. Khawkin has an article on the buccal apparatus of the *Euglenæ* and *Astasiæ*, as also on the laws of heredity in the case of unicellular organisms; and Dr. Kultchitsky studies the intestinal canals of several fishes.—Geology and mineralogy are represented by R. Prendel's article on the Wiluite, from which it appears that the crystals of this interesting mineral have a double composition—those parts of it which penetrate into the depth of the crystal as cones set upon the surfaces of the pyramids differing both by their density and refractive power from the parts which are built upon the faces of the prisms; three papers by Prof. Sintsoff on the water-bearing deposits of Kishineff, the Steppe deposits on the left bank of the Lower Volga, and the Pliocene of South Russia; and on the crystalline rocks of Crimea, by M. Prendel.—Prof. Klossovsky contributes a paper on the oscillations of temperature and density of the water of the Black Sea in the neighbourhoods of Odessa; and Mrs. Mary Balashoff has an article on the influence of small ponds and of limited supplies of water on the development of *Planorbis*.—Chemistry is represented by one paper, on the laws of dissolution of salts, by R. Umoff.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 26.—"On the Occurrence of Aluminium in Certain Vascular Cryptogams." By A. H. Church, M.A., F.C.S. Communicated by Dr. J. H. Gilbert, F.R.S.

Most of the older and more complete analyses of plant-ashes disclosed the presence of sensible quantities of alumina. But of late years this substance has been regarded as accidental, and has been excluded from ash-constituents with the single exception of certain species of *Lycopodium*. Since 1851 several analysts have proved the presence of large quantities of alumina in the ashes of these plants The author has confirmed and extended their results, and has shown that the allied genus *Selaginella* does not absorb alumina. He found, however, two species of *Lycopodium*—namely, *L. Phlegmaria* and *L. billardieri*—from which this constituent is absent. The anomaly was explained by the epiphytic nature of these plants, which have no direct access to the soil. The author has further examined certain species belonging to genera nearly related to *Lycopodium*, such as *Equisetum*, *Ophioglossum*, *Salvinia*, *Marsilea*, and *Psilotum*, in all cases with negative results. But he has found 20 per cent. of alumina in the ash of a New Zealand tree-fern, and has also discovered abundance of this substance in *Cyathea medullaris* and *Alsophila australis*, and more than mere traces in *Dicksonia squarrosa*. The last part of the paper is occupied with some considerations having reference to the connection between elementary plant-food and the periodic law.

May 17.—"On the Electromotive Properties of the Leaf of *Dionæa* in the Excited and Unexcited States." No. II. By J. Burdon-Sanderson, M.A., M.D., F.R.S., Professor of Physiology in the University of Oxford.

The author has continued his experimental inquiries, of which the results were communicated to the Royal Society under the same title in 1881. In the introduction to the paper he gives a summary of his previous observations, which led to the conclusion that the property by virtue of which the excitable structures of the leaf respond to stimulation, is of the same nature with that possessed by the similarly-endowed structures of animals. He then proceeds to state that the main purpose of his subsequent investigations has been to determine the relation between two sets of phenomena which might, in accordance with the language commonly used in animal physiology, be termed respectively those of the "resting current" and of the "action current" of the leaf, *i.e.* between the electrical properties possessed by the leaf when stimulated, and those which it displays when at rest. Assuming the excitatory response in the leaf to be of the same nature as the excitatory variation or "action current" in muscle and nerve, the question has to be answered, whether in the leaf the response is a sudden diminution of a previously existing electromotive action (according to the pre-existence theory of du Bois-Reymond), or the setting up at the moment of stimulation of a new electromotive action—in short, whether and in how far the two sets of phenomena are inter-dependent or the contrary.

An observation recorded in his former paper suggested proper methods. It had been shown that by passing a weak voltaic current through the leaf for a short period in a particular direction, its electromotive properties could be permanently *modified* without loss of its excitability. If it could be shown that the influence of this modification extended to both orders of phenomena, those of rest and excitation, and that both underwent corresponding changes of character under similar conditions, this would go far to prove that an essential relation existed between them.

Acting on this suggestion, the author has had recourse to modes of experiment similar to those which have been employed during the last few years in the investigation of the newly-discovered "secondary electromotive" phenomena of muscle and nerve (see "Oxford Biological Memoirs," vol. i. part 2). The details of these experiments, made in 1885, are given in the first three sections of the paper. They relate to (1) the more immediate effect of the current as seen in the records of successive galvanometric observations made at regular intervals; (2) the more permanent influence of the current on the electromotive properties of the unexcited leaf, and on its electrical resistance; and (3) the concomitant modification of its behaviour when stimulated.

The general result of these experiments is to show that the two orders of phenomena, the excitatory and those which relate to the resting state, are so linked together that every change in the state of the leaf when at rest conditionates a corresponding change in the way in which it reacts to stimulation—the correspondence consisting in this, that the direction of the response is opposed to that of the previous difference of potential between the opposite surfaces, so that as the latter changes from ascending to descending, the former changes from descending to ascending.

The author considers that this can only be understood to mean that the constantly operative electromotive forces which find their expression in the persistent difference of potential between the opposite surfaces, and those more transitory ones which are called into momentary existence by touching the sensitive filaments or by other modes of stimulation, have the same seat, and that the

opposition between them is in accordance with a principle applicable in common to the excitable structures of plants and animals, viz. that the *property which renders a structure capable of undergoing excitatory change is expressed by relative positivity, the condition of discharge by relative negativity.*

The fourth section of the paper is devoted to an investigation made in 1887, of the events of the first second after excitation, made with the aid of a pendulum-rheotome specially adapted for the purpose. The fifth contains the description of the records obtained by photographing the electrical phenomena of the excitatory reaction, as observed with the aid of the capillary electrometer, on rapidly-moving plates. Both of these series of observations serve to confirm and complete the results obtained by other methods. The photographs were exhibited.

Physical Society, May 12.—Prof. Reinold, F.R.S., President, in the chair.—The following papers were read:—Note on the condition of self-excitation in a dynamo machine, by Prof. S. P. Thompson. It is a well-known fact that a series dynamo running at a given speed will not excite itself unless the resistance is less than a certain value, depending on the speed and construction of the machine, and if the resistance is slightly less than this critical value the excitation will not be such as to saturate the magnets. According to the primitive statement of the action of self-exciting dynamos on the "compound interest law," a dynamo should excite itself to saturation at any finite speed providing the resistance is not infinite. An explanation of the observed facts is given in the paper, without any assumption as to the curve of magnetization. If E = E.M.F. of the machine, n = speed, C = number of wires on outside of armature, N = number of magnetic lines, i = current, S = number of turns on magnet, ΣR and $\Sigma\rho$ the sums of the electric and magnetic resistances respectively, then $E = nCN$, $i = nCN/\Sigma R$, and $N = 4\pi Si/\Sigma\rho$. From these it is easily seen that $4\pi nCS = \Sigma\rho \,.\, \Sigma R$, (A). ; *i.e.* for a dynamo running at constant speed the product of the magnetic and electric resistances is constant, and the dynamo will not excite itself if ΣR is greater than $4\pi nCS/\Sigma\rho$. Similarly for a given value of ΣR, excitation is impossible if n is less than $\Sigma\rho \,.\, \Sigma R/4\pi CS$. For a value of ΣR less than the critical value the excitation increases until the magnetic resistance is increased so that equation (A) is satisfied. The corresponding formula for shunt machines is $4\pi nCZ = \Sigma\rho\left\{(r_a + r_s) + \frac{r_a r_s}{R}\right\}$; where Z = number of shunt turns ; r_a, r_s, and R, the resistances of armature, shunt, and external circuits respectively. In the discussion which followed, Mr. Kapp described a method used in testing dynamos, for determining the minimum speed at which dynamos will excite themselves, and from thence determining the magnetic resistance of the air gap. In all cases experiment showed this to be less than the calculated resistance, generally in the proportion of 1500 to 1860, the difference being greater in low-tension machines. Prof. Ayrton pointed out that permanent magnetism was not taken into account, and that the apparent resistance due to self-induction, and between the brushes and commutator were considerable for small currents. Lord Rayleigh and Sir W. Thomson had shown critical speeds for given resistances to exist in Faraday's disk dynamo. He (Lord Rayleigh) did not approve of the term "magnetic resistance," and thought "reluctance," as recently suggested by Mr. Heaviside, would be preferable.—Note on the conditions of self-regulation in a constant potential dynamo machine, by the same author. In "Dynamo-Electric Machinery" a formula $\frac{Z}{S} = \frac{r_s}{r_a + r_m}$ is given as expressing the ratio of the number of turns in the shunt and series windings of a compound dynamo. This is on the assumption that there is no saturation within the working limits. As this assumption is not legitimate, a correcting factor is necessary. The factor is shown to be the ratio of the average permeability over the whole working range to the permeability corresponding with no external current. The formula is transformed so as to be expressed in terms of the "satural" data of the machine, which, as shown in a previous paper, can be calculated from its details.—On magnetic lag, and the work lost due to magnetic lag in alternating current transformers, by Mr. Thomas H. Blakesley. The method adopted to detect the lag is to place dynamometers in both circuits, and one with a coil in each. Then, on the supposition that the E.M.F. of the secondary circuit is entirely due to the changing magnetism of the core, the author proves that the tangent of the magnetic lag angle must be equal to $\frac{\frac{m}{n} Ca_3 - Ba_2}{\frac{m}{n}\sqrt{(AB a_1 a_2 - C^2 a_3^2)}}$; where m and n are the number of turns in the primary and secondary coils respectively; A, B, C, the constants of the dynamometers; and a_1, a_2, a_3, their angular reading. A is such that $Aa_1 = \frac{I_1^2}{2}$, where I_1 is the maximum value of the primary current. A table of actual results is given, where the magnetic lag is about 5¼°. The whole power given out by the machine takes the form $r_1 A a_1 + r_2 \frac{m}{n} C d_2$, where r_1 and r_2 are the resistances of the primary and secondary circuits, while the power lost in hysteresis is expressed by $r_2\left(\frac{m}{n} Ca_3 - Ba_2\right)$. The lag is attributed to an induced magnetic stress called into being by the increasing or decreasing magnetism itself, and always opposing it as motion in a medium induces an opposing force of friction. By supposing such an induced magnetic stress in quadrature (as Mr. Blakesley expresses it) with the magnetism, and of such a value as when compounded with the stresses due to the currents shall bring the resultant into quadrature with the secondary current, the effective magnetic stress is obtained. This involves a new idea called magnetic self-induction with its coefficient. The whole problem is treated by the geometrical method, which the author has applied to several other problems in alternating currents. Mr. Kapp, Profs. Thompson, Perry, and Ayrton, and Lord Rayleigh took part in discussing the paper.—On a simple apparatus for the measurement of the coefficient of expansion by heat, by Prof. W. E. Ayrton, F.R.S., and Prof. J. Perry, F.R.S. The apparatus consists of a metal tube, within which the wire or rod whose coefficient is to be determined is placed. One end of the wire is rigidly attached to one end of the tube, and the other end connected to an Ayrton and Perry magnifying spring, a pointer attached to which indicates the change of length due to alteration of temperature. Steam or water may be passed through the tube, the temperature of the wire being shown on a thermometer. The arrangement is very sensitive, and with a pointer about 20 cm. long, the motion is magnified about 1000 times.—A magnifying spring attached to an aneroid was also shown, and its great sensibility demonstrated. A combination of a spring of large diameter and pitch with one of small diameter and pitch was exhibited. By such a combination small rotations can be immensely magnified. The great features of the patent spring as a magnifier are the entire absence of friction and back lash, and the large range of proportionality.

Chemical Society, May 17.—Mr. W. Crookes, F.R.S., in the chair.—The following papers were read:—Researches on the constitution of azo- and diazo-derivatives; (iv.) diazo-amido-compounds, by Prof. Meldola, F.R.S., and Mr. F. W. Streatfield.—The colour of some carbon compounds, by Prof. Carnelly, and Mr. J. Alexander. An investigation of a number of metallic derivatives of ortho- and para-nitrophenol has given the following results: (1) in all cases without exception the colour passes towards the red end of the spectrum as the temperature rises; (2) the colour of the ortho-derivative is nearer the red end than that of the corresponding para-compound; (3) a comparison of the nitrophenates of the metals belonging to the same sub-group shows that the colour passes towards the red end as the atomic weight of the metal increases; (4) when the same salt occurs in both the anhydrous and the hydrated state, the colour passes towards the red end as the quantity of water of crystallization diminishes; (5) as regards the salts investigated, the para-compound always takes up a larger quantity of water of crystallization than the corresponding ortho-compound. In the course of the discussion which followed the reading of the paper, Prof. Armstrong, F.R.S., remarked that the facts advanced were far too few to justify the very general conclusions arrived at by the authors; all who had worked with the nitrophenols were well aware that the colour changed on heating in the manner described; and there was no novelty in the statement that the para-nitrophenols crystallized with the larger proportion of water. Referring to the authors' fourth deduction, he quoted calcium parachlorodiorthonitrophenate as an exception, since this compound can be obtained either in yellow anhydrous crystals, or in deep-orange hydrated crystals.—The identity of natural and

artificial salicylic acid, by Prof. Hartley, F.R.S. Spectroscopic examination of the two compounds establishes their identity.—Researches on the relation between the molecular structure of carbon compounds and their absorption spectra (part viii.), by the same.—A definition of the term atomic weight and its reference to the periodic law, by the same. The author is of opinion that the fact that the atomic weights are real measures of the quantity of matter in the atoms of the elements is often overlooked, and advocates the adoption of the definition: The atomic weight of an element is the ratio of the mass of its atom to the mass of an atom of hydrogen. The periodic law then admits of being stated thus: The properties of the atoms are a periodic function of their masses.

Geological Society, May 23.—Dr. W. T. Blanford, F.R.S., President, in the chair.—The following communications were read:—On the spheroid-bearing granite of Mullaghderg, Co. Donegal, by Dr. Frederick H. Hatch. Communicated with the permission of the Director-General of the Geological Survey. This paper deals with a remarkable variety of granite which may be compared with the well-known orbicular diorite or Napoleonite of Corsica. According to Mr. J. R. Kilroe, of the Geological Survey of Ireland, who first discovered this interesting rock, the concretionary balls occur in close juxtaposition in a mass of granite of 5 or 6 cubic yards in size. They have not been found in any other portion of the granite area. The author gave a detailed description of the microscopic structure of the normal granite. He also described the spheroidal bodies, and gave a synopsis of the literature concerning the occurrence of similar concretionary bodies in granite. The conclusion arrived at was, that concretionary bodies occurring in granite may, according to the mode of arrangement of their constituents, be divided into three classes, viz. (1) the *concretionary patches* of Phillips; (2) the *granospherites* of Vogelsang; (3) the *belonospherites* of Vogelsang. The spheroids from Mullaghderg belong to the last-mentioned class. They must be regarded as concretions formed, during the consolidation of the granite magma, by a process of zonal and radial crystallization around an earlier-formed nucleus. Remarks on this paper were offered by Mr. Rutley, Prof. Bonney, Dr. Hicks, and Prof. Judd.—On the skeleton of a Sauropterygian from the Oxford Clay near Bedford, by R. Lydekker.—On the Eozoic and Palæozoic rocks of the Atlantic coast of Canada in comparison with those of Western Europe and the interior of America, by Sir J. W. Dawson, F.R.S. The author referred to the fact that since 1845 he had contributed to the Proceedings of the Geological Society a number of papers on the geology of the eastern maritime provinces of Canada, and it seemed useful to sum up the geology of the older formations and make such corrections and comparisons as seemed warranted by the new facts obtained by himself, and by other observers of whom mention is made in the paper. With reference to the Laurentian, he maintained its claim to be regarded as a regularly stratified system probably divisible into two or three series, and characterized in its middle or upper portion by the accumulation of organic limestone, carbonaceous beds, and iron-ores on a vast scale. He also mentioned the almost universal prevalence in the northern hemisphere of the great plications of the crust which terminated this period, and which necessarily separate it from all succeeding deposits. He next detailed its special development on the coast of the Atlantic, and the similarity of this with that found in Great Britain and elsewhere in the west of Europe. The Huronian he defined as a littoral series of deposits skirting the shores of the old Laurentian uplifts, and referred to some rocks which may be regarded as more oceanic equivalents. Its characters in Newfoundland, Cape Breton, and New Brunswick were referred to, and compared with the Pebidian, &c., in England. The questions as to an upper member of the Huronian or an intermediate series, the Basal Cambrian of Matthew in New Brunswick, were discussed. The very complete series of Cambrian rocks now recognized on the coast-region of Canada was noticed, in connection with its equivalency in details to the Cambrian of Britain and of Scandinavia, and the peculiar geographical conditions implied in the absence of the Lower Cambrian over a large area of interior America. In the Ordovician age a marginal and a submarginal area existed on the east coast of America. The former is represented largely by bedded igneous rocks, the latter by the remarkable series named by Logan the Quebec Group, which was noticed in detail in connection with its equivalents further west, and also in Europe. The Silurian, Devonian, and Carboniferous were then treated of, and detailed evidence shown as to their conformity to the types of Western Europe rather than to those of America. In conclusion, it was pointed out that though the great systems of formations can be recognized throughout the northern hemisphere, their divisions must differ in the maritime and inland regions, and that hard and fast lines should not be drawn at the confines of systems, nor widely different formations of the same age reduced to an arbitrary uniformity of classification not sanctioned by Nature. It was also inferred that the evidence pointed to a permanent continuance of the Atlantic basin, though with great changes of its boundaries, and to a remarkable parallelism of the formations deposited on its eastern and western sides. The President, whilst recognizing the importance of the paper, doubted whether the question of correlation of the Pre-Cambrian rocks on either side of the Atlantic was ripe for discussion. Dr. Hicks agreed with most of the conclusions of the author, including the correlation of the Huronian with the Pebidian. Some observations on the paper were also made by Dr. Scott, Dr. Hinde, and Mr. Marr.—On a hornblende-biotite rock from Dusky Sound, New Zealand, by Captain F. W. Hutton.

Zoological Society, May 15.—Dr. A. Günther, F.R.S., Vice-President, in the chair.—The Secretary read a report on the additions that had been made to the Society's Menagerie during the month of April 1888; and called special attention to two Rock-hopper Penguins from the Auckland Islands, presented by Capt. Sutcliff, R.M.S.S. *Aorangi*, on April 19; also to two Indian Hill-Foxes, and to a fine example of the Spotted Hawk-Eagle (*Spizaëtus nipalensis*), presented by Colonel Alex. A. A. Kinloch, and received on April 20.—A communication was read from Mr. George A. Treadwell, containing an account of a fatal case of poisoning from the bite of the Gila Monster (*Heloderma suspectum*).—Mr. Boulenger exhibited the type-specimen of a singular new genus of Snakes (*Azemiops feæ*) recently discovered by M. Fea, of the Museo Civico of Genoa, in the Kakhim Hills, Upper Burma. Mr. Boulenger proposed to refer this genus provisionally to the family Elapidæ.—The Secretary read a letter addressed to him by Mr. E. C. Cotes, Entomological Department, Indian Museum, Calcutta, respecting the insect-pests of India, and requesting the assistance of entomologists in working out the species to which they belong.—Mr. H. Seebohm exhibited and made remarks on a series of specimens of Pheasants from Mongolia, Tibet, and China, including examples of the two species discovered by Colonel Prjevalski, *Phasianus strauchi* and *P. vlangali*.—Prof. F. Jeffrey Bell exhibited and made remarks on three specimens of a large Pennatulid (*Funiculina quadrangularis*) obtained by Mr. John Murray on the west coast of Scotland. They showed very clearly the differences between examples of this species of different ages.—Mr. R. Bowdler Sharpe gave an account of a third collection of birds made by Mr. L. Wray in the main range of mountains of the Malay Peninsula, Perak. The present paper contained descriptions of ten species new to science, amongst which was a new *Pericrocotus*, proposed to be called *P. wrayi*.—Prof. F. Jeffrey Bell read the descriptions of four new species of Ophiuroids from various localities.—Mr. F. E. Beddard read a paper containing remarks on certain points in the visceral anatomy of *Balæniceps rex* bearing upon its affinities, which he considered to be with the Ardeidæ rather than with the Ciconiidæ. Mr. G. B. Sowerby gave the description of a gigantic new species of Mollusk of the genus *Aspergillum* from Japan, which he proposed to name *A. giganteum*.

Institution of Civil Engineers, May 29.—Annual General Meeting.—Mr. George B. Bruce, President, in the chair.—After the reading of the Report, hearty votes of thanks were passed to the President, to the Vice-Presidents, and other members of the Council, to the Auditors, to the Secretaries and staff, and to the Scrutineers.—The ballot for the Council resulted in the election of Mr. G. B. Bruce, as President; of Sir John Coode, Mr. G. Berkley, Mr. H. Hayter, and Mr. A. Giles, M.P., as Vice-Presidents; and of Mr. W. Anderson, Mr. B. Baker, Mr. J. W. Barry, Sir Henry Bessemer, F.R.S., Mr. E. A. Cowper, Sir James N. Douglass, F.R.S., Sir Douglas Fox, Mr. C. Hawksley, Mr. J. Mansergh, Mr. W. H. Preece, F.R.S., Sir Robert Rawlinson, K.C.B., Sir E. J. Reed, K.C.B., F.R.S., M.P., Mr. W. Shelford, Mr. F. C. Stileman, and Sir William Thomson, F.R.S., as other members of the Council.—The Council has made the following awards to the authors of some of the papers read and discussed at the ordinary meetings during the past session, or printed in

the minutes of proceedings without being discussed, as well as for papers read at the supplemental meetings of students :—For papers read and discussed at the ordinary meetings: a Telford Medal and a Telford Premium to Robert Abbott Hadfield, for "Manganese in its Application to Metallurgy," and "Some Newly-discovered Properties of Iron and Manganese"; a Watt Medal and a Telford Premium to Peter William Willans, for "Economy-Trials of a Non-condensing Steam-Engine, Simple, Compound, and Triple"; a Telford Medal and a Telford Premium to Dr. Edward Hopkinson, for "Electrical Tramways—the Bessbrook and Newry Tramway"; a Watt Medal and a Telford Premium to Edward Bayzand Ellington, for "The Distribution of Hydraulic Power in London"; a Telford Medal and a Telford Premium to Josiah Pierce, Jun., for "The Economic Use of the Plane-Table in Topographical Surveying"; a George Stephenson Medal and a Telford Premium to Sir Bradford Leslie, K.C.I.E., for "The Erection of the 'Jubilee' Bridge, carrying the East Indian Railway across the River Hooghly at Hooghly"; and the Manby Premium to the late Hamilton Goodall, for "The Use and Testing of Open-hearth Steel for Boiler-making." For papers printed in the Proceedings without being discussed: a Watt Medal and a Telford Premium to Prof. Victor Auguste Ernest Dwelshauvers-Dèry, for "A New Method of Investigation applied to the Action of Steam-Engine Governors"; and Telford Premiums to William Mann Thompson, for "Improved Systems of Chaining for Land and Engineering Surveys"; to James William Wyatt, for "Sizing Paper with Rosin"; and to Dugald Drummond, for "The Heating of Carriages by Exhaust Steam on the Caledonian Railway." For papers read at the supplemental meetings of students the following Miller Prizes have been given: to David Sing Capper, for "The Speed-Trials of the latest addition to the *Admiral* Class of British War-Vessels"; to Lawrence Gibbs, for "Pumping-Machinery in the Fenland and by the Trentside"; to Harold Medway Martin, for "Arched Ribs and Voussoir Arches"; to John Henry Parkin, for "River-Gauging at the Vyrnwy Reservoir"; to Alfred Chatterton, for "The Prevention and Extinction of Fires"; to John Holliday, for "Boiler Experiments and Fuel-Economy"; to Arthur Wharton Metcalfe, for "The Classification of Continous Railway-Brakes"; to Robert Jarratt Money, for "Railway Engineering in British North America."

Victoria Institute, June 4.—The annual general meeting was held at the house of the Society of Arts. The President, Prof. G. G. Stokes, P.R.S., M.P., took the chair. The twenty-second Annual Report was read by Captain Frank Petrie, the Honorary Secretary, and Sir Monier-Williams delivered an address on mystical Buddhism. A vote of thanks was accorded to the President.

PARIS.

Academy of Sciences, May 28.—M. Janssen, President, in the chair.—New theory of equatorials (continued), by MM. Lœwy and Puiseux. In order to verify the already explained theory, the authors here compare the values of the constants obtained by physical processes with those resulting from the astronomical methods based on the observation of transits or on the apparent variations of the right ascensions or declinations. They conclude with some general remarks on the employment of the equatorial *coudé*.—On the measurement of low temperatures, by MM. L. Cailletet and E. Colardeau. The researches here described have been undertaken for the purpose of obviating the difficulties hitherto felt in employing hydrogen thermometers for the measurement of low temperatures.—Researches on ruthenium, by MM. H. Debray and A. Joly. These studies are occupied chiefly with the ruthenates of potassa and silver, and the heptaruthenates of potassa and soda. The authors find that, although there exists an evident analogy in the composition and reactions of the ruthenate and heptaruthenate of potassa on the one hand, and the manganate and permanganate of potassa on the other, no relation of isomorphism has been detected between the salts of the acids of ruthenium and those of manganese. The ruthenate of potassa is hydrated, while the manganate, like the sulphate, is anhydrous.—On the monthly charts of the North Atlantic currents, by M. Simart. Continuing the work of Commander Brault, the author has prepared two series of charts (diagrams and results) based on 60,400 observations obtained from the records of the French Admiralty and various other sources. The charts of results give the currents most likely to be met with from month to month all the year round, while the diagrams indicate the currents that may possibly be met, especially near the coasts, where they present the greatest dangers to seafarers.—Origin of the aurora borealis, by M. Jean Luvini. This phenomenon is regarded as analogous to the discharge of electricity in thunderstorms, the only difference consisting in their different degrees of intensity. Both are attributed to the friction of particles of water and ice and occasionally of other minute bodies drawn by the aërial currents into the higher atmospheric regions and disseminated over the terrestrial atmosphere some hundred miles thick. The northern lights are most frequent about the pole, where the air abounds most in icy particles and where the field of terrestrial magnetism is most intense.—Observations of the new planet Palisa (279) made at the Observatory of Algiers with the 0·50m. telescope, by MM. Rambaud and Sy. These observations, which include the positions of two comparison stars and the apparent positions of the planet, cover the period from May 18 to May 22.—Observations of the planet Borelly (278) made at the Observatory of Marseilles with the 0·26m. Eichens equatorial, by M. Esmiol. During these observations, continued from May 13 to May 21, the planet appeared to be of magnitude 11·5.—On the supernumerary arcs accompanying the rainbow, by M. Boitel. The position of these arcs, as determined by Airy on the principles of diffraction, and generally accepted as absolute, is shown to be merely a first approximation, which the author hopes soon to supplement by more accurate calculations.—Researches on the application of the rotatory power to the study of the compounds formed by the action of the neutral tungstates of soda and potassa on the solutions of tartaric acid, by M. D. Gernez. From these experiments it appears that the neutral tungstates of soda and potassa behave analogously in their action on tartaric acid.—On the sesquisulphide of rhodium, by M. E. Leidié. The author describes the methods of preparation of this substance and of the double sulphides both by the wet and dry processes.—On two isomerous naphthoquinoleins, by M. Alphonse Combes. The only terms hitherto known of these rare compounds are those obtained by Skraup by making glycerine act on the naphthylamines in the presence of sulphuric acid. The author here describes two new terms of the series, as well as a means by which several others may also be obtained.—On a new species of Coregonus, by M. Victor Fatio. To this species, discovered in the French Lake Bourget, the author has given the name of *Coregonus Bezola*. It is a well-defined local variety.—On the germination of *Anemone apennina*, by M. Ed. de Janczewski. This species presents in its germination a curious and most remarkable anomaly, differing in this respect from all other dicotyledonous plants.—On the bust of a woman carved in the root of an equine tooth, by M. Ed. Piette. This specimen of prehistoric art, recently discovered by the author in the cave of Mas d'Azil, Ariège, presents several points of interest to the anthropologist. Owing to the contracted space, the artist had to suppress shoulders and arms, merely suggesting the outlines of the sides. But the pendant breasts are well executed, and the profile of the face carefully delineated. The nose is large and rounded, the lips thick, the chin retreating like that of the Naulette jaw, but the forehead is high and not receding like that of the Neanderthal skull. It is the third extant representation of a woman of the Quaternary period, the two others being M. de Vibraye's "Venus" and the "Reindeer Woman," both from Laugerie-Basse.

BERLIN.

Physical Society, May 18.—Prof. du Bois-Reymond, President, in the chair.—Dr. Dieterici gave an account of his experiments on the determination of the latent heat of evaporation of water at 0° C. Regnault's experiments on the latent heat of evaporation of water were made at higher temperatures, and had led to the construction of a formula according to which the latent heat of evaporation at 0° C. must be 607 units of heat. The speaker, using an ice-calorimeter, had made a direct determination of this value. A glass tube, with its lower end blown out into a bulb and filled with water, was immersed in the chamber of the calorimeter, the upper end of the tube being connected with an air-pump, and a small column of sulphuric acid being interposed between the pump and the tube. As soon as the apparatus had assumed a perfectly uniform temperature, a vacuum was produced by the air-pump, whereupon the water in the tube evaporated, taking up from the calorimeter the heat necessary for its evaporation. Values were obtained from a series of ten experiments, which differed from each other by not more than $\frac{3}{4}$ per cent. In order to meet the objection which might be raised—namely, that the temperature at which

the evaporation took place was not 0° C.,—Dr. Dieterici repeated his experiments, using a platinum instead of a glass tube. The values obtained in this set of experiments only differed by ¼ per cent. The mean of the two sets of experiments was identical, and the final outcome of the whole research was that the latent heat of evaporation of water at 0° C. is 596·4 thermal units. The speaker then discussed fully the theoretical significance of the above results, and described an experiment he had made in order to determine the latent heat of evaporation of ice at 0° C. The method employed was the same as above, but it did not yield the value which was theoretically expected, which should have been equal to the sum of the latent heat of evaporation of water and of the latent heat of fusion of ice. The cause of the divergence was due to the fact that the ice used was not clear and crystalline, but milky and opaque. Dr. Dieterici intends to repeat these determinations next winter.—Prof. von Bezold gave an account of a paper which he had recently read before the Berlin Academy on the thermodynamics of the atmosphere. Recent meteorology has derived very considerable benefit from the application of thermodynamics to events taking place in the atmosphere; but up to the present time all the researches had only dealt with adiabatic and reversible processes. As a matter of fact, these processes are neither adiabatic nor reversible, since, when the air is cooled, its aqueous vapour is condensed, and the water thus formed falls as either rain, hail, or snow. If both these facts are taken into account, the calculations involved thereby become so complicated that Prof. von Bezold was only enabled to proceed to the application of thermodynamics to the processes which really take place in the atmosphere by employing an artifice; the latter consisted of the graphic method introduced by Clapeyron with such marked success as a technical method. For this purpose the consideration starts with the assumption that the air is dry, in which case the equation for its condition is given in terms of its volume, pressure, and temperature, and can be represented by plane co-ordinates. The variable amount of aqueous vapour in the air is then treated as a further variable in the third co-ordinate, in such a way that for any given amount of aqueous vapour in the air a new co-ordinate representing the change in condition of the air is obtained. When, on cooling, a portion of this aqueous vapour is condensed, the curve representing the change of condition passes over from one plane to the other, pursuing its further course in the latter plane. In this way it becomes possible, as the speaker fully showed, to treat non-reversible and pseudo-adiabatic processes theoretically, according to the laws of thermodynamics. It can thus be shown in the case of the Föhn and of cyclones, as well as of anticyclones, which are not reversible but reversed processes, that the theoretical considerations lead to results which are found to be confirmed by experience. Thus, according to theory, in an anticyclone occurring in winter, there should be a rise of temperature at some height above the earth, a fact which is now observed at all meteorological stations at high altitudes.

Physiological Society, May 25.—Prof. du Bois-Reymond, President, in the chair.—Dr. Weyl gave an account of the results of his further researches on silk. Among the products of decomposition of albumen and proteid substances, one is known as a snowy crystalline body, which is considered to be leucin, and is generally regarded as being also a product of the decomposition of silk. Since this substance may be obtained in large quantities by the decomposition of silk, the speaker had prepared it from this source and analyzed it, and has come to the conclusion that it is not leucin (amidocaproic acid), but rather another amidated acid—namely, alanin. Of the two possible isomers of alanin, it is α-alanin which is obtained by the decomposition of silk. Dr. Weyl laid stress on the fact that Schützenberger had also concluded that alanin and glycocol occur among the products of decomposition of silk, notwithstanding that, during his elaborate and careful researches on proteids, he employed a method which is as unfavourable as can be imagined for determining this point: this result is now confirmed by the speaker's researches. Schützenberger's further supposition, that an amido-acid of the acrylic series can be prepared from silk, was not supported by Dr. Weyl's analyses.—The same speaker further communicated the results of his researches on the physiological action of anthrarobin and chrysarobin, which have recently been largely used in medical practice. These two substances, whose chemical constitution and relationship to alizarin and anthracene have been made clear by Liebermann, are largely used as reducing-bodies, especially in skin diseases. Dr. Weyl endeavoured, by means of experiments on rabbits and dogs, and on himself, to determine the physiological action of anthrarobin, and found that it possesses absolutely no action on the living organism, even when taken by the mouth in relatively large doses, or injected subcutaneously. It could be detected in an unaltered condition in the urine, so that this substance, notwithstanding that it possesses a great affinity for oxygen, passes through the body without being oxidized. Chrysarobin, on the other hand, has a very different action; notwithstanding its close relationship to the non-injurious anthrarobin, it has a powerfully poisonous action, so that all experiments made with it were of necessity confined to rabbits and dogs. The speaker was unable to confirm the statements of several authors that chrysarobin reappears in the urine as chrysophanic acid. It is rather his opinion that chrysarobin is first excreted in an unaltered condition, and only subsequently undergoes a change into chrysophanic acid. It remains for further experiments to clear up this point.—Prof. Gad spoke on the phosphorescent moss *Schistostega osmundacea*, which he had been for some time cultivating, and which he exhibited. A thorough investigation of the phosphorescent powers of this plant promises a rich harvest of facts from a physical point of view: it is well known, on the basis of morphological research, that the phosphorescence is due to a reflection of the incident light.

In the report of the Berlin Meteorological Society, May 1 (p. 119), the expression "a spring-vane," should have been "a vane made of feathers."

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Travels in Arabia Deserta, 2 vols.: C. M. Doughty (Cambridge Press).—Modern Science in Bible Lands: Sir J. W. Dawson (Hodder and Stoughton).—Catalog der Conchylien-Sammlung, Lief. 7: Fr. Paetel (Berlin).—Charts showing the Mean Barometrical Pressure over the Atlantic, Indian, and Pacific Oceans (Eyre and Spottiswoode).—Inorganic Chemistry, 2nd edition: by Kolbe, translated and edited by Humpidge (Longmans).—Longmans' Test Cards in Mechanics, Stages I., II., III. (Longmans).—Flora of North America (the Gamopetalæ): Dr. Asa Gray (Smithsonian Institution, Washington).—La Biologie Végétale: P. Vuillemin (Baillière, Paris).—Applications of Dynamics to Physics and Chemistry: J. J. Thomson (Macmillan).—Lingua: G. J. Henderson (Trübner).

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